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(54) DEVICE AND METHOD FOR PROCESSING INFORMATION SIGNAL,
IMAGE SIGNAL PROCESSOR, IMAGE DISPLAY DEVICE USING THE
SAME, DEVICE AND METHOD FOR GENERATING COEFFICIENT
SPECIES DATA USED BY THE SAME, DEVICE AND METHOD FOR
GENERATING COEFFICIENT DATA AND INFORMATION PROVIDING
MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To freely adjust image quality with a plurality of

axes.

SOLUTION: An image signal processing part 110 converts an SD signal into an HD signal. A class is detected from the pixel data of a tap corresponding to a pixel under consideration of the HD signal fetched selectively from the SD signal to obtain a class code CL showing the class of the pixel under consideration of the HD signal. A memory bank 135 stores the coefficient species data of each class. A coefficient generation circuit 136 generates the coefficient data of each class by a generation expression including parameters (h) and (v) on the basis of the coefficient basic data of each class and the values of a plurality of image quality adjustment parameters (h) and (v) by a user operation, and stores the coefficient data of each class in a memory 134. An arithmetic circuit 127 operates the pixel data of the pixel under consideration of the HD signal from the data x_i of the tap corresponding to the pixel under consideration of the HD signal fetched selectively from the SD signal in a tap selection circuit 121 and coefficient data W_i read from the memory 134 with the class code CL by using an estimated equation.

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CLAIMS

[Claim(s)]

[Claim 1] Process the function of 1 determined out of two or more functions to the 1st information signal inputted, and the 2nd information signal is generated. A parameter input means to be the information signal processor which outputs this 2nd information signal, and to input the value of the parameter which opts for top Norikazu's function out of two or more above-mentioned functions, The information signal processor characterized by having an information data generation means to generate the information data which constitute the 2nd information signal of the above from information data which constitute the 1st information signal of the above corresponding to the value of the parameter inputted with the above-mentioned parameter input means.

[Claim 2] Process the function of 1 determined out of two or more functions to the 1st information signal inputted, and the 2nd information signal is generated. The 1st step which inputs the value of the parameter which is the information signal art which outputs this 2nd information signal, and opts for top Norikazu's function out of two or more above-mentioned functions, The information signal art characterized by having the 2nd step which generates the information data which constitute the 2nd information signal of the above from information data which constitute the 1st information signal of the above corresponding to the value of the parameter inputted at the 1st step of the above.

[Claim 3] It is the information signal processor which changes the 1st information signal which consists of two or more information data into the 2nd information signal which consists of two or more information data. The 1st data selection means which chooses from the 1st information signal of the

above two or more 1st information data located around the observing point concerning the 2nd information signal of the above, A class detection means to detect the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen with the data selection means of the above 1st, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd information signal of the above, The information signal processor characterized by having an information data generation means to generate the information data of the above-mentioned observing point, corresponding to the value of two or more kinds of parameters adjusted with the class and the above-mentioned parameter adjustment device which were detected with the above-mentioned class detection means.

[Claim 4] The above-mentioned information data generation means was beforehand searched for for every class detected with the above-mentioned class detection means. The 1st memory means which memorizes the multiplier kind data which are generation-type multiplier data containing the parameter of the above-mentioned two or more classes which generate presumed-type multiplier data, It is generated by the above-mentioned generation type using the multiplier kind data memorized by the memory means of the above 1st, and the value of two or more kinds of parameters adjusted with the above-mentioned parameter adjustment device. A multiplier data generating means to generate the above-mentioned presumed-type multiplier data corresponding to the value of two or more kinds of parameters adjusted with the class and the above-mentioned parameter adjustment device which were detected with the above-mentioned class detection means, The 2nd data selection means which chooses from the 1st information signal of the above two or more 2nd information data located around the observing point concerning the 2nd information signal of the above, From the above-mentioned multiplier data generated with the above-mentioned multiplier data generating means, and the 2nd information data of the above-mentioned plurality chosen with the data selection means of the above 2nd The information signal processor according to claim 3 characterized by having an

operation means to compute and obtain the information data of the above-mentioned observing point using the above-mentioned presumed type.

[Claim 5] The value of two or more kinds of parameters by which adjustment was carried out [above-mentioned] with the multiplier kind data memorized by the memory means of the above 1st is used for the above-mentioned multiplier data generating means. By the above-mentioned generation type A multiplier data generation means detected with the above-mentioned class detection means to generate above-mentioned presumed-type multiplier data for every class, The 2nd memory means which memorizes the above-mentioned presumed-type multiplier data in each class generated with the above-mentioned multiplier data generation means, The information signal processor according to claim 4 characterized by coming to have a multiplier data read-out means to read and output the above-mentioned presumed-type multiplier data corresponding to the class detected with the above-mentioned class detection means from the memory means of the above 2nd.

[Claim 6] The information signal processor according to claim 4 carried out [having further an addition means to ask for total of the above-mentioned presumed-type multiplier data generated with the above-mentioned multiplier data generating means, and a normalization means to do the division of the information data of the above-mentioned observing point acquired with the above-mentioned operation means, and to normalize them by the above-mentioned total, and] as the description.

[Claim 7] The above-mentioned information data generation means has the memory which memorizes the presumed-type multiplier data beforehand generated for every combination of the value of two or more kinds of parameters adjusted with the class and the above-mentioned parameter adjustment device which are detected with the above-mentioned class detection means. A multiplier data generating means to generate the above-mentioned presumed-type multiplier data corresponding to the value of two or more kinds of parameters adjusted with the class and the above-mentioned parameter adjustment device which were detected with the above-mentioned class detection means, The 2nd data selection means which chooses from the 1st information signal of the above two or more 2nd information data

located around the observing point concerning the 2nd information signal of the above, From the above-mentioned multiplier data generated with the above-mentioned multiplier data generating means, and the 2nd information data of the above-mentioned plurality chosen with the data selection means of the above 2nd The information signal processor according to claim 3 characterized by having an operation means to compute and obtain the information data of the above-mentioned observing point using the above-mentioned presumed type.

[Claim 8] The 1st memory section which memorizes the above-mentioned presumed-type multiplier data which are adjusted with the class and the above-mentioned parameter adjustment device with which the above-mentioned multiplier data generating means is detected with the above-mentioned class detection means, and which was beforehand generated for every combination of the value of two or more kinds of parameters, The 1st data read-out means which reads the multiplier data of each class corresponding to the value of two or more kinds of parameters adjusted with the above-mentioned parameter adjustment device from the memory section of the above 1st, The 2nd memory section which memorizes the multiplier data of each class read with the data read-out means of the above 1st, The information signal processor according to claim 7 characterized by coming to have the 2nd data read-out means which reads the multiplier data corresponding to the class detected with the above-mentioned class detection means from the memory section of the above 2nd.

[Claim 9] The above-mentioned parameter adjustment device is an information signal processor according to claim 3 characterized by coming to have a display means to display the adjustment position of the parameter of the above-mentioned two or more classes, and a user actuation means to adjust the value of the parameter of the above-mentioned two or more classes with reference to the display of the above-mentioned display means.

[Claim 10] It is the picture signal processor which changes the 1st picture signal which consists of two or more pixel data into the 2nd picture signal which consists of two or more pixel data. A data selection means to choose from the 1st picture signal of the above two or more pixel data located around

the attention pixel concerning the 2nd picture signal of the above, A class detection means to detect the class to which the above-mentioned attention pixel belongs based on two or more above-mentioned pixel data chosen with the above-mentioned data selection means, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd picture signal of the above, The picture signal processor characterized by having a pixel data generation means to generate the pixel data of the above-mentioned attention pixel, corresponding to the value of two or more kinds of parameters adjusted with the class and the above-mentioned parameter adjustment device which were detected with the above-mentioned class detection means.

[Claim 11] A picture signal input means to input the 1st picture signal which consists of two or more pixel data, A picture signal processing means to change and output the 1st picture signal of the above inputted from the above-mentioned picture signal input means to the 2nd picture signal which consists of two or more pixel data, An image display means to display the image by the 2nd picture signal of the above outputted from the above-mentioned picture signal processing means on an image display component, It comes to have the parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the image quality of the above-mentioned image displayed on the above-mentioned image display component. The above-mentioned picture signal processing means A data selection means to choose from the 1st picture signal of the above two or more pixel data located around the attention pixel concerning the 2nd picture signal of the above, A class detection means to detect the class to which the above-mentioned attention pixel belongs based on two or more above-mentioned pixel data chosen with the above-mentioned data selection means, The image display device characterized by having a pixel data generation means to generate the pixel data of the above-mentioned attention pixel, corresponding to the value of two or more kinds of parameters adjusted with the class and the above-mentioned parameter adjustment device which were detected with the above-mentioned class detection means.

[Claim 12] The above-mentioned parameter adjustment device is an image

display device according to claim 11 characterized by coming to have a display-control means to display the adjustment position of the parameter of the above-mentioned two or more classes on the above-mentioned image display component, and a user actuation means to adjust the value of the parameter of the above-mentioned two or more classes with reference to the adjustment position of the parameter of the above-mentioned two or more classes displayed on the above-mentioned image display component.

[Claim 13] It is the information signal art which changes the 1st information signal which consists of two or more information data into the 2nd information signal which consists of two or more information data. The 1st step which chooses from the 1st information signal of the above two or more 1st information data located around the observing point concerning the 2nd information signal of the above, The 2nd step which detects the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen at the 1st step of the above, The 3rd step which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd information signal of the above, The information signal art characterized by having the 4th step which generates the information data of the above-mentioned observing point corresponding to the value of two or more kinds of parameters adjusted at the class and the 3rd step of the above which were detected at the 2nd step of the above.

[Claim 14] The step which generates the presumed-type multiplier data corresponding to the value of two or more kinds of parameters adjusted at the class and the 3rd step of the above from which the 4th step of the above was detected at the 2nd step of the above, The step which chooses from the 1st information signal of the above two or more 2nd information data located around the observing point concerning the 2nd information signal of the above, The information signal art according to claim 13 characterized by having the step which computes the information data of the above-mentioned observing point using the above-mentioned presumed type from the multiplier data and the 2nd information data of the above-mentioned plurality by which generating was carried out [above-mentioned].

[Claim 15] At the step which generates the above-mentioned multiplier data, ask beforehand for every class detected at the 2nd step of the above. The multiplier kind data which are generation-type multiplier data containing the parameter of the above-mentioned two or more classes which generate above-mentioned presumed-type multiplier data, and the value of two or more kinds of parameters adjusted at the 3rd step of the above are used. By the above-mentioned generation type The information signal art according to claim 14 characterized by computing and obtaining the above-mentioned presumed-type multiplier data corresponding to the value of two or more kinds of parameters adjusted at the class and the 3rd step of the above which were detected at the 2nd step of the above.

[Claim 16] The information signal art according to claim 15 characterized by to have further the 6th step which carries out the multiplication of the information data of the above-mentioned observing point acquired at the 5th step which asks for total of the above-mentioned presumed-type multiplier data generated at the step which generates the above-mentioned multiplier data, and the 4th step of the above, and normalizes them by the above-mentioned total asked at the 5th step of the above.

[Claim 17] From the storage section the above-mentioned presumed-type multiplier data for every combination of the value of two or more kinds of parameters adjusted in the step which generates the above-mentioned multiplier data at the class and the 3rd step of the above which are detected at the 2nd step of the above were remembered to be It is based on the value of two or more kinds of parameters adjusted at the class and the 3rd step of the above which were detected at the 2nd step of the above. The information signal art according to claim 14 characterized by reading and obtaining the above-mentioned presumed-type multiplier data corresponding to the value of two or more kinds of parameters adjusted at the class and the 3rd step of the above which were detected at the 2nd step of the above.
 [Claim 18] In order to change the 1st information signal which consists of two or more information data into the 2nd information signal which consists of two or more information data The 1st step which chooses from the 1st information signal of the above two or more information data located around the observing point

concerning the 2nd information signal of the above, The 2nd step which detects the class to which the above-mentioned observing point belongs based on two or more above-mentioned information data chosen at the 1st step of the above, The 3rd step which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd information signal of the above, The information offer medium which offers the computer program for performing the 4th step which generates the information data of the above-mentioned observing point corresponding to the value of two or more kinds of parameters adjusted at the class and the 3rd step of the above which were detected at the 2nd step of the above.

[Claim 19] It is equipment which generates the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. A signal-processing means to process the teacher signal corresponding to the 2nd information signal of the above, and to acquire the input signal corresponding to the 1st information signal of the above, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the above-mentioned input signal, The 1st data selection means which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, A class detection means to detect the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen with the data selection means of the above 1st, The 2nd data selection means which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen with the class and the data selection means of the above 2nd which were detected with the

above-mentioned class detection means Multiplier kind data generation equipment characterized by having a normal equation generation means to generate the normal equation for obtaining the above-mentioned multiplier kind data, and a multiplier kind data operation means to solve the above-mentioned normal equation and to obtain the above-mentioned multiplier kind data for every above-mentioned class, for every class.

[Claim 20] It is the approach of generating the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. The 1st step which processes the teacher signal corresponding to the 2nd information signal of the above, and acquires the input signal corresponding to the 1st information signal of the above, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the above-mentioned input signal, The 3rd step which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, The 4th step which detects the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen at the 3rd step of the above, The 5th step which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen at the class detected at the 4th step of the above, and the 5th step of the above The multiplier kind data generation method characterized by having the 6th step which generates the normal equation for obtaining the above-mentioned multiplier kind data, and the 7th step which solves the above-mentioned normal equation and obtains the above-mentioned multiplier kind data for every above-mentioned class for every class.

[Claim 21] In order to generate the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data The 1st step which processes the teacher signal corresponding to the 2nd information signal of the above, and acquires the input signal corresponding to the 1st information signal of the above, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the above-mentioned input signal, The 3rd step which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, The 4th step which detects the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen at the 3rd step of the above, The 5th step which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen at the class detected at the 4th step of the above, and the 5th step of the above The information offer medium which offers the computer program for performing the 6th step which generates the normal equation for obtaining the above-mentioned multiplier kind data, and the 7th step which solves the above-mentioned normal equation and obtains the above-mentioned multiplier kind data for every above-mentioned class for every class.

[Claim 22] It is equipment which generates the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. A signal-processing means to process the teacher signal corresponding to the 2nd information signal of the above, and

to acquire the input signal corresponding to the 1st information signal of the above, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the above-mentioned input signal, The 1st data selection means which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, A class detection means to detect the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen with the data selection means of the above 1st, The 2nd data selection means which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen with the class and the data selection means of the above 2nd which were detected with the above-mentioned class detection means The 1st normal equation generation means which generates the 1st normal equation for obtaining above-mentioned presumed-type multiplier data for every combination of the value of the parameter of the above-mentioned class and the above-mentioned two or more classes, A multiplier data operation means to solve the 1st normal equation of the above and to obtain above-mentioned presumed-type multiplier data for every above-mentioned combination, The 2nd normal equation generation means which generates the 2nd normal equation for obtaining the above-mentioned multiplier kind data for every class from the multiplier data for every above-mentioned combination obtained with the above-mentioned multiplier data operation means, Multiplier kind data generation equipment characterized by solving the 2nd normal equation of the above and having a multiplier kind data operation means to obtain the above-mentioned multiplier kind data for every above-mentioned class.

[Claim 23] It is the approach of generating the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier

data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. The 1st step which processes the teacher signal corresponding to the 2nd information signal of the above, and acquires the input signal corresponding to the 1st information signal of the above, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the above-mentioned input signal, The 3rd step which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, The 4th step which detects the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen at the 3rd step of the above, The 5th step which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen at the class detected at the 4th step of the above, and the 5th step of the above The 6th step which generates the 1st normal equation for obtaining above-mentioned presumed-type multiplier data for every combination of the value of a class and two or more kinds of parameters, The 7th step which solves the 1st normal equation of the above and obtains above-mentioned presumed-type multiplier data for every above-mentioned combination, The 8th step which generates the 2nd normal equation for obtaining the above-mentioned multiplier kind data for every class from the multiplier data for every above-mentioned combination obtained at the 7th step of the above, The multiplier kind data generation method characterized by solving the 2nd normal equation of the above and having the 9th step which obtains the above-mentioned multiplier kind data for every above-mentioned class.

[Claim 24] In order to generate the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in

case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data The 1st step which processes the teacher signal corresponding to the 2nd information signal of the above, and acquires the input signal corresponding to the 1st information signal of the above, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the above-mentioned input signal, The 3rd step which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, The 4th step which detects the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen at the 3rd step of the above, The 5th step which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen at the class detected at the 4th step of the above, and the 5th step of the above The 6th step which generates the 1st normal equation for obtaining above-mentioned presumed-type multiplier data for every combination of the value of a class and two or more kinds of parameters, The 7th step which solves the 1st normal equation of the above and obtains above-mentioned presumed-type multiplier data for every above-mentioned combination, The 8th step which generates the 2nd normal equation for obtaining the above-mentioned multiplier kind data for every class from the multiplier data for every above-mentioned combination obtained at the 7th step of the above, The information offer medium which offers the computer program for performing the 9th step which solves the 2nd normal equation of the above and obtains the above-mentioned multiplier kind data for every above-mentioned class.

[Claim 25] It is equipment which generates the presumed-type multiplier data used in case the 1st information signal which consists of two or more

information data is changed into the 2nd information signal which consists of two or more information data. A signal-processing means to process the teacher signal corresponding to the 2nd information signal of the above, and to acquire the input signal corresponding to the 1st information signal of the above, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the above-mentioned input signal, The 1st data selection means which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, A class detection means to detect the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen with the data selection means of the above 1st, The 2nd data selection means which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen with the class and the data selection means of the above 2nd which were detected with the above-mentioned class detection means A normal equation generation means to generate the normal equation for obtaining above-mentioned presumed-type multiplier data for every combination of the value of the parameter of the above-mentioned class and the above-mentioned two or more classes, Multiplier data generation equipment characterized by having a multiplier data operation means to solve the above-mentioned normal equation and to obtain the above-mentioned multiplier data for every above-mentioned combination.

[Claim 26] It is the approach of generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. The 1st step which processes the teacher signal corresponding to the 2nd information signal of the above, and acquires the input signal corresponding to the 1st information signal of the above, The 2nd step which adjusts the value of two or more kinds of parameters which

determine the quality of the output obtained by the above-mentioned input signal, The 3rd step which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, The 4th step which detects the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen at the 3rd step of the above, The 5th step which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen at the above-mentioned class detected at the 4th step of the above, and the 5th step of the above The 6th step which generates the normal equation for obtaining above-mentioned presumed-type multiplier data for every combination of the value of the parameter of the above-mentioned class and the above-mentioned two or more classes, The multiplier data generation method characterized by having the 7th step which solves the above-mentioned normal equation generated at the 6th step of the above, and obtains the above-mentioned multiplier data for every above-mentioned combination.

[Claim 27] In order to generate the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data The 1st step which processes the teacher signal corresponding to the 2nd information signal of the above, and acquires the input signal corresponding to the 1st information signal of the above, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the above-mentioned input signal, The 3rd step which chooses from the above-mentioned input signal two or more 1st information data located around the observing point concerning the above-mentioned teacher signal, The 4th step which detects the class to which the above-mentioned observing point belongs based on the 1st information data of the above-mentioned plurality chosen at the 3rd step of

the above, The 5th step which chooses from the above-mentioned input signal two or more 2nd information data located around the observing point concerning the above-mentioned teacher signal, From the information data of the observing point concerning the 2nd information data and above-mentioned teacher signal of the above-mentioned plurality which were chosen at the above-mentioned class detected at the 4th step of the above, and the 5th step of the above The 6th step which generates the normal equation for obtaining above-mentioned presumed-type multiplier data for every combination of the value of the parameter of the above-mentioned class and the above-mentioned two or more classes, The information offer medium which offers the computer program for performing the 7th step which solves the above-mentioned normal equation generated at the 6th step of the above, and obtains the above-mentioned multiplier data for every above-mentioned combination.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the information signal processor which processes functions, such as for example, a resolution rise, noise oppression, a decryption, and conversion of a signal format, and an information signal art. The information signal processor which enabled it to realize processing of two or more functions with single equipment is started by generating the information data which constitute the 2nd information signal out of the information data which constitute the 1st information signal out of two or more functions in detail corresponding to the value of the parameter which chooses the function of 1.

[0002] This invention relates to an information offer medium at the image display device which applied when changing the video signal of NTSC system

into the video signal of Hi-Vision, and used a suitable information signal processor, an information signal art, a picture signal processor, and it, the multiplier kind data generation equipment used for it and a generation method, multiplier data generation equipment and a generation method, and a list. In detail, in case the 1st information signal is changed into the 2nd information signal, the information signal processor which enabled it to perform freely adjustment of the quality of the output obtained by the 2nd information signal, for example, image quality, with two or more shafts is started by generating the 2nd information signal corresponding to the value of two or more kinds of parameters.

[0003]

[Description of the Prior Art] In recent years, from the audio-visual-oriented rise, development of the television receiver which can obtain the image of high resolution more was desired, and the so-called Hi-Vision was developed in response to this request. The number of scanning lines of Hi-Vision is 1125 twice [more than] as many as this to the number of scanning lines of NTSC system being 525. Moreover, the aspect ratio of Hi-Vision is 9:16 to the aspect ratio of NTSC system being 3:4. For this reason, in Hi-Vision, the image which has presence with high resolution can be displayed compared with NTSC system.

[0004] Although Hi-Vision has the property which was excellent in this way, even if it supplies the video signal of NTSC system as it is, image display by the Hi-Vision method cannot be performed. This is because specification differs with NTSC system and Hi-Vision as mentioned above.

[0005] Then, in order to display the image according to the video signal of NTSC system by the Hi-Vision method, these people proposed the inverter for changing the video signal of NTSC system into the video signal of Hi-Vision previously (refer to Japanese Patent Application No. No. 205934 [six to]). In this inverter, the pixel data of the block (field) corresponding to the attention pixel concerning the video signal of Hi-Vision are extracted from the video signal of NTSC system, the class of the above-mentioned attention pixel is determined based on the level distribution pattern of the pixel data of this block, and the pixel data of the above-mentioned attention pixel are generated

corresponding to this class.

[0006] Moreover, these people proposed the inverter mentioned above, the inverter (refer to JP,2000-138950,A) changed into a component signal from a composite signal with the same configuration, the equipment (refer to application for patent No. 135356 [2000 to]) which decodes an MPEG (Moving Picture Experts Group) picture signal, etc.

[0007]

[Problem(s) to be Solved by the Invention] In the inverter changed into the video signal of Hi-Vision from the video signal of the NTSC system mentioned above, it is fixed and resolution of the image by the video signal of Hi-Vision was not able to be made into desired resolution like adjustments, such as the conventional contrast and sharpness, according to the contents of an image etc. Moreover, each conventional equipment mentioned above does not process a respectively single function, and was not efficient.

[0008] This invention aims at offering the information signal processor which can realize processing of two or more functions with single equipment.

Moreover, this invention aims at offering the information signal processor which enabled it to adjust image quality of an image freely with two or more shafts, such as horizontal resolution, vertical definition, and whenever [noise rejection], a horizontal/vertical definition.

[0009]

[Means for Solving the Problem] As opposed to the 1st information signal into which the information signal processor concerning this invention is inputted Process the function of 1 determined out of two or more functions, and the 2nd information signal is generated. A parameter input means to be the information signal processor which outputs this 2nd information signal, and to input the value of the parameter which opts for the function of 1 out of two or more functions, It has an information data generation means to generate the information data which constitute the 2nd information signal from information data which constitute the 1st information signal corresponding to the value of the parameter inputted with this parameter input means.

[0010] Moreover, the information signal art concerning this invention receives the 1st information signal inputted. Process the function of 1 determined out of

two or more functions, and the 2nd information signal is generated. The 1st step which inputs the value of the parameter which is the information signal art which outputs this 2nd information signal, and opts for the function of 1 out of two or more functions, It has the 2nd step which generates the information data which constitute the 2nd information signal from information data which constitute the 1st information signal corresponding to the value of the parameter inputted at this 1st step.

[0011] In this invention, the 1st information signal is inputted, processing of the function of 1 chosen from two or more functions is performed to this 1st information signal, the 2nd information signal is generated, and this 2nd information signal is outputted. In this case, the value of the parameter which opts for the function of 1 out of two or more functions is inputted. For example, when an information signal is a picture signal, two or more functions are a resolution rise, noise oppression, a decryption, conversion of a signal format, etc.

[0012] Thus, corresponding to the value of the inputted parameter, the information data which constitute the 2nd information signal from information data which constitute the 1st information signal are generated. By this, a switch of a function will be performed by the value of the parameter inputted. That is, processing of two or more functions is realizable with single equipment.

[0013] The information signal processor concerning this invention is an information signal processor which changes the 1st information signal which consists of two or more information data into the 2nd information signal which consists of two or more information data. The 1st data selection means which chooses from the 1st information signal two or more 1st information data located around the observing point concerning the 2nd information signal, A class detection means to detect the class to which the above-mentioned observing point belongs based on two or more 1st information data chosen with this 1st data selection means, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd information signal, Corresponding to the value of two or more kinds of parameters adjusted with the class and

parameter adjustment device which were detected with the class detection means, it has an information data generation means to generate the information data of the above-mentioned observing point.

[0014] For example, the 1st memory means which memorizes the multiplier kind data which are generation-type multiplier data containing two or more kinds of parameters which generate the presumed-type multiplier data with which an information data generation means is detected with a class detection means, and which were beforehand called for for every class, It is generated by the above-mentioned generation type using the multiplier kind data memorized by this 1st memory means and the value of two or more kinds of parameters adjusted with the parameter adjustment device. A multiplier data generating means to generate the above-mentioned presumed-type multiplier data corresponding to the value of two or more kinds of parameters adjusted with the class and parameter adjustment device which were detected with the class detection means, The 2nd data selection means which chooses from the 1st information signal two or more 2nd information data located around the observing point concerning the 2nd information signal, It has an operation means to compute and obtain the information data of an observing point from the multiplier data generated with the multiplier data generating means, and two or more 2nd information data chosen with the 2nd data selection means using the above-mentioned presumed type.

[0015] Moreover, for example, an information data generation means has the memory which memorizes the presumed-type multiplier data beforehand generated for every combination of the value of two or more kinds of parameters adjusted with the class and parameter adjustment device which are detected with a class detection means. A multiplier data generating means to generate the above-mentioned presumed-type multiplier data corresponding to the value of two or more kinds of parameters adjusted with the class and parameter adjustment device which were detected with the class detection means, The 2nd data selection means which chooses from the 1st information signal two or more 2nd information data located around the observing point concerning the 2nd information signal, It has an operation means to compute and obtain the information data of an observing point from

the multiplier data generated with the multiplier data generating means, and two or more 2nd information data chosen with the 2nd data selection means using the above-mentioned presumed type.

[0016] Moreover, the information signal art concerning this invention is an information signal art which changes the 1st information signal which consists of two or more information data into the 2nd information signal which consists of two or more information data. The 1st step which chooses from the 1st information signal two or more 1st information data located around the observing point concerning the 2nd information signal, The 2nd step which detects the class to which the above-mentioned observing point belongs based on two or more 1st information data chosen at this 1st step, The 3rd step which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd information signal, Corresponding to the value of two or more kinds of parameters adjusted at the class detected at the 2nd step, and the 3rd step, it has the 4th step which generates the information data of the above-mentioned observing point.

[0017] Moreover, the information offer medium concerning this invention offers the computer program for performing each step of an above-mentioned information signal art.

[0018] Moreover, the picture signal processor concerning this invention is a picture signal processor which changes the 1st picture signal which consists of two or more pixel data into the 2nd picture signal which consists of two or more pixel data. A data selection means to choose from the 1st picture signal two or more pixel data located around the attention pixel concerning the 2nd picture signal, A class detection means to detect the class to which the above-mentioned attention pixel belongs based on two or more pixel data chosen with this data selection means, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd picture signal, Corresponding to the value of two or more kinds of parameters adjusted with the class and parameter adjustment device which were detected with the class detection means, it has a pixel data generation means to generate the pixel data of the above-mentioned attention pixel.

[0019] Moreover, a picture signal input means to input the 1st picture signal with which the image display device concerning this invention consists of two or more pixel data, A picture signal processing means to change and output the 1st picture signal inputted from this picture signal input means to the 2nd picture signal which consists of two or more pixel data, It comes to have the parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the image quality of the image displayed on this image display component as an image display means to display the image by the 2nd picture signal outputted from this picture signal processing means on an image display component. And a data selection means by which a picture signal processing means chooses from the 1st picture signal two or more pixel data located around the attention pixel concerning the 2nd picture signal, A class detection means to detect the class to which the above-mentioned attention pixel belongs based on two or more pixel data chosen with this data selection means, Corresponding to the value of two or more kinds of parameters adjusted with the class and parameter adjustment device which were detected with this class detection means, it has a pixel data generation means to generate the pixel data of the above-mentioned attention pixel.

[0020] In this invention, two or more 1st information data located around the observing point concerning the 2nd information signal are chosen from the 1st information signal, and the class to which the above-mentioned observing point belongs is detected based on two or more of those 1st information data. For example, the level distribution pattern of two or more 1st information data is detected, and the class to which the above-mentioned observing point belongs based on this level distribution pattern is detected. Here, information signals are a picture signal and a sound signal.

[0021] The value of two or more kinds of parameters which determine the quality of the output obtained by the 2nd information signal with a parameter adjustment device is adjusted. For example, when an information signal is a picture signal, the value of a parameter is adjusted and the image quality of the image by the 2nd information signal (picture signal) is decided. Moreover, when an information signal is a sound signal, the value of a parameter is adjusted and the tone quality of the voice by the 2nd information signal (sound

signal) is decided. For example, a parameter adjustment device is considered as the configuration which has a display means to display the adjustment position of two or more kinds of parameters, and a user actuation means to adjust the value of two or more kinds of parameters with reference to the display of this display means. Thereby, a user operates a user actuation means, for example, a pointing device, and can adjust easily the value of two or more kinds of parameters to a request location.

[0022] And the information data of an observing point are generated corresponding to the detected class and the adjusted value of two or more kinds of parameters. For example, the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data beforehand called for for every class are memorized by the memory means. While using with this multiplier kind data and the value of the adjusted parameter and generating the class [which was detected] and presumed-type multiplier data corresponding to the adjusted value of two or more kinds of parameters Two or more 2nd information data located around the observing point concerning the 2nd information signal are chosen from the 1st information signal, and the information data of the above-mentioned observing point are generated from this multiplier data and two or more 2nd information data using a presumed type.

[0023] Moreover, for example, the presumed-type multiplier data beforehand generated for every combination of the value of a class and two or more kinds of parameters are memorized by memory. While the class [which was detected from this memory] and presumed-type multiplier data corresponding to the adjusted value of two or more kinds of parameters are read Two or more 2nd information data located around the observing point concerning the 2nd information signal are chosen from the 1st information signal, and the information data of the above-mentioned observing point are generated from this multiplier data and two or more 2nd information data using a presumed type.

[0024] Thus, the presumed-type multiplier data corresponding to the value of two or more kinds of adjusted parameters are obtained, this multiplier data is used, and the information data of the observing point which starts the 2nd

information signal by the presumed type are generated. Therefore, two or more shafts, such as horizontal resolution, vertical definition, and whenever [noise reduction], level/vertical definition, can perform freely adjustment of the quality of the output obtained by the 2nd information signal, for example, image quality.

[0025] Moreover, the multiplier kind data generation equipment concerning this invention It is equipment which generates the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. A signal-processing means to process the teacher signal corresponding to the 2nd information signal, and to acquire the input signal corresponding to the 1st information signal, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the input signal, The 1st data selection means which chooses from an input signal two or more 1st information data located around the observing point concerning a teacher signal, A class detection means to detect the class to which the above-mentioned observing point belongs based on two or more 1st information data chosen with this 1st data selection means, The 2nd data selection means which chooses from an input signal two or more 2nd information data located around the observing point concerning a teacher signal, From the information data of the observing point concerning two or more the 2nd information data and teacher signals which were chosen with the class and the 2nd data selection means which were detected with the class detection means It has a normal-equation generation means to generate the normal equation for obtaining multiplier kind data, and a multiplier kind data operation means to solve a normal equation and to obtain multiplier kind data for every class, for every class.

[0026] Moreover, the multiplier kind data generation method concerning this invention It is the approach of generating the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier

data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. The 1st step which processes the teacher signal corresponding to the 2nd information signal, and acquires the input signal corresponding to the 1st information signal, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the input signal, The 3rd step which chooses from an input signal two or more 1st information data located around the observing point concerning a teacher signal, The 4th step which detects the class to which an observing point belongs based on two or more 1st information data chosen at this 3rd step, The 5th step which chooses from an input signal two or more 2nd information data located around the observing point concerning a teacher signal, The 6th step which generates the normal equation for obtaining multiplier kind data for every class from the information data of the observing point concerning two or more the 2nd information data and teacher signals which were chosen at the class detected at the 4th step, and the 5th step, It has the 7th step which solves a normal equation and obtains multiplier kind data for every class.

[0027] Moreover, the information offer medium concerning this invention offers the computer program for performing each step of an above-mentioned multiplier kind data generation method.

[0028] In this invention, the teacher signal corresponding to the 2nd information signal is processed, and the input signal corresponding to the 1st information signal is acquired. In this case, the quality of the output obtained by the input signal is determined with the value of two or more kinds of adjusted parameters. For example, when an information signal is a picture signal, the value of two or more kinds of parameters is adjusted, and the image quality of the image by the input signal is decided. Moreover, when an information signal is a sound signal, the value of two or more kinds of parameters is adjusted, and the tone quality of the voice by the input signal is decided.

[0029] Two or more 1st information data located around the observing point

concerning a teacher signal are chosen from this input signal, and the class to which the above-mentioned observing point belongs is detected based on two or more of those 1st information data. Moreover, two or more 2nd information data located around the observing point concerning a teacher signal are chosen from this input signal.

[0030] And the value of two or more kinds of parameters is adjusted to two or more steps, the normal equation for obtaining multiplier kind data for every class is generated from the information data of the observing point concerning the class to which the observing point concerning a teacher signal belongs, two or more 2nd selected information data, and a teacher signal, and the multiplier kind data for every class are obtained by solving this equation.

[0031] Here, multiplier kind data are generation-type multiplier data containing the parameter of the above-mentioned two or more classes which generate the presumed-type multiplier data used in case it changes into the 2nd information signal from the 1st information signal. It becomes possible to obtain the multiplier data corresponding to the value of two or more kinds of parameters adjusted to arbitration by the generation type by using this multiplier kind data. Thereby, when changing into the 2nd information signal from the 1st information signal using a presumed type, two or more shafts can adjust freely the quality of the output obtained by the 2nd information signal by adjusting the value of two or more kinds of parameters.

[0032] Moreover, the multiplier kind data generation equipment concerning this invention It is equipment which generates the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. A signal-processing means to process the teacher signal corresponding to the 2nd information signal, and to acquire the input signal corresponding to the 1st information signal, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the input signal, The 1st data selection means which chooses

from an input signal two or more 1st information data located around the observing point concerning a teacher signal, A class detection means to detect the class to which an observing point belongs based on two or more 1st information data chosen with this 1st data selection means, The 2nd data selection means which chooses from an input signal two or more 2nd information data located around the observing point concerning a teacher signal, From the information data of the observing point concerning two or more the 2nd information data and teacher signals which were chosen with the class and the 2nd data selection means which were detected with the class detection means The 1st normal equation generation means which generates the 1st normal equation for obtaining presumed-type multiplier data for every combination of the value of a class and two or more kinds of parameters, A multiplier data operation means to solve this 1st normal equation and to obtain presumed-type multiplier data for every above-mentioned combination, The 2nd normal equation generation means which generates the 2nd normal equation for obtaining multiplier kind data for every class from the multiplier data for every above-mentioned combination obtained with this multiplier data operation means, This 2nd normal equation is solved and it has a multiplier kind data operation means to obtain multiplier kind data for every class.

[0033] The multiplier kind data generation method concerning this invention is the approach of generating the multiplier kind data which are generation-type multiplier data for generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. The 1st step which processes the teacher signal corresponding to the 2nd information signal, and acquires the input signal corresponding to the 1st information signal, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output which corresponds to two or more kinds of parameters contained in the above-mentioned generation type, and is obtained by the input signal, The 3rd step which chooses from an input signal two or more 1st information data located around the observing point concerning a teacher signal, The 4th step

which detects the class to which an observing point belongs based on two or more 1st information data chosen at this 3rd step, The 5th step which chooses from an input signal two or more 2nd information data located around the observing point concerning a teacher signal, From the information data of the observing point concerning two or more the 2nd information data and teacher signals which were chosen at the class detected at the 4th step, and the 5th step The 6th step which generates the 1st normal equation for obtaining presumed-type multiplier data for every combination of the value of a class and two or more kinds of parameters, The 7th step which solves this 1st normal equation and obtains presumed-type multiplier data for every above-mentioned combination, It has the 8th step which generates the 2nd normal equation for obtaining multiplier kind data for every class from the multiplier data for every above-mentioned combination obtained at this 7th step, and the 9th step which solves this 2nd normal equation and obtains multiplier kind data for every class.

[0034] Moreover, the information offer medium concerning this invention offers the computer program for performing each step of an above-mentioned multiplier kind data generation method.

[0035] In this invention, the teacher signal corresponding to the 2nd information signal is processed, and the input signal corresponding to the 1st information signal is acquired. In this case, the quality of the output obtained by the input signal is determined with the value of two or more kinds of adjusted parameters. For example, when an information signal is a picture signal, the value of two or more kinds of parameters is adjusted, and the image quality of the image by the input signal is decided. Moreover, when an information signal is a sound signal, the value of two or more kinds of parameters is adjusted, and the tone quality of the voice by the input signal is decided.

[0036] Two or more 1st information data located around the observing point concerning a teacher signal are chosen from this input signal, and the class to which the above-mentioned observing point belongs is detected based on two or more of those 1st information data. Moreover, two or more 2nd information data located around the observing point concerning a teacher signal are

chosen from this input signal.

[0037] And the class to which the observing point that sequential adjustment is carried out in two or more steps, and the value of two or more kinds of parameters is applied to a teacher signal belongs, From the information data of the observing point concerning two or more the 2nd selected information data and teacher signals The 1st normal equation for obtaining presumed-type multiplier data is generated for every combination of the value of a class and two or more kinds of parameters, and the presumed-type multiplier data for every above-mentioned combination are obtained by solving this equation.

[0038] And the multiplier kind data for every class are obtained by the 2nd normal equation for obtaining multiplier kind data being generated for every class, and solving this equation from the multiplier data for every above-mentioned combination, further.

[0039] Here, multiplier kind data are generation-type multiplier data containing the parameter of the above-mentioned two or more classes which generate the presumed-type multiplier data used in case it changes into the 2nd information signal from the 1st information signal. It becomes possible to obtain the multiplier data corresponding to the value of two or more kinds of parameters adjusted to arbitration by the generation type by using this multiplier kind data. Thereby, when changing into the 2nd information signal from the 1st information signal using a presumed type, two or more shafts can adjust freely the quality of the output obtained by the 2nd information signal by adjusting the value of two or more kinds of parameters.

[0040] Moreover, the multiplier data generation equipment concerning this invention It is equipment which generates the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. A signal-processing means to process the teacher signal corresponding to the 2nd information signal, and to acquire the input signal corresponding to the 1st information signal, The parameter adjustment device which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the input signal, The 1st data selection means which chooses from an input signal two or more 1st

information data located around the observing point concerning a teacher signal, A class detection means to detect the class to which an observing point belongs based on two or more 1st information data chosen with this 1st data selection means, The 2nd data selection means which chooses from an input signal two or more 2nd information data located around the observing point concerning a teacher signal, From the information data of the observing point concerning two or more the 2nd information data and teacher signals which were chosen with the class and the 2nd data selection means which were detected with the class detection means It has a normal equation generation means to generate the normal equation for obtaining presumed-type multiplier data, and a multiplier data operation means to solve this normal equation and to obtain the multiplier data for every above-mentioned combination, for every combination of the value of a class and two or more kinds of parameters.

[0041] Moreover, the multiplier data generation method concerning this invention It is the approach of generating the presumed-type multiplier data used in case the 1st information signal which consists of two or more information data is changed into the 2nd information signal which consists of two or more information data. The 1st step which processes the teacher signal corresponding to the 2nd information signal, and acquires the input signal corresponding to the 1st information signal, The 2nd step which adjusts the value of two or more kinds of parameters which determine the quality of the output obtained by the input signal, The 3rd step which chooses from an input signal two or more 1st information data located around the observing point concerning a teacher signal, The 4th step which detects the class to which an observing point belongs based on two or more 1st information data chosen at this 3rd step, The 5th step which chooses from an input signal two or more 2nd information data located around the observing point concerning a teacher signal, From the information data of the observing point concerning two or more the 2nd information data and teacher signals which were chosen at the class detected at the 4th step, and the 5th step It has the 6th step which generates the normal equation for obtaining presumed-type multiplier data, and the 7th step which solves the normal equation generated at this 6th step,

and obtains the multiplier data for every above-mentioned combination for every combination of the value of a class and two or more kinds of parameters.

[0042] Moreover, the information offer medium concerning this invention offers the computer program for performing each step of an above-mentioned multiplier data generation method.

[0043] In this invention, the teacher signal corresponding to the 2nd information signal is processed, and the input signal corresponding to the 1st information signal is acquired. In this case, the quality of the output obtained by the input signal is determined with the value of two or more kinds of adjusted parameters. For example, when an information signal is a picture signal, the value of two or more kinds of parameters is adjusted, and the image quality of the image by the input signal is decided. Moreover, when an information signal is a sound signal, the value of two or more kinds of parameters is adjusted, and the tone quality of the voice by the input signal is decided.

[0044] Two or more 1st information data located around the observing point concerning a teacher signal are chosen from this input signal, and the class to which the above-mentioned observing point belongs is detected based on two or more of those 1st information data. Moreover, two or more 2nd information data located around the observing point concerning a teacher signal are chosen from this input signal.

[0045] And the class to which the observing point that the value of two or more kinds of parameters is adjusted to two or more steps, and is applied to a teacher signal belongs, From the information data of the observing point concerning two or more the 2nd selected pixel data and teacher signals The normal equation for obtaining presumed-type multiplier data is generated for every combination of the value of a class and two or more kinds of parameters, and the presumed-type multiplier data for every above-mentioned combination are obtained by solving this normal equation.

[0046] Although the presumed-type multiplier data used in case the 1st information signal is changed into the 2nd information signal, as it mentioned above are generated In case it changes into the 2nd information signal from

the 1st information signal, the class to which the observing point concerning the 2nd information signal belongs, and the multiplier data corresponding to the adjusted value of two or more kinds of parameters are used alternatively, and the information data of an observing point are computed by the presumed type. Thereby, when changing into the 2nd information signal from the 1st information signal using a presumed type, two or more shafts can adjust freely the quality of the output obtained by the 2nd information signal by adjusting the value of two or more kinds of parameters.

[0047]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is explained, referring to a drawing. Drawing 1 shows the configuration of the television receiver 100 as a gestalt of operation. This television receiver 100 acquires 525i signals as an SD (Standard Definition) signal from a broadcast signal, changes this 525i signal into 525p signals or 1050i signals as an HD (High Definition) signal, and displays the image by that 525p signal or 1050i signals.

[0048] Here, as for 525i signals, the number of Rhine means the picture signal of an interlace method by 525, as for 525p signals, the number of Rhine means the picture signal of a progressive method (non-interlace method) by 525, and, as for 1050i signals, the number of Rhine means the picture signal of an interlace method by 1050 in the pan.

[0049] The television receiver 100 is equipped with a microcomputer and has the system controller 101 for controlling system-wide actuation, and the remote control signal receive circuit 102 which receives a remote control signal. It connects with a system controller 101 and the remote control signal receive circuit 102 receives the remote control signal RM outputted according to actuation of a user from the remote control transmitter 200, and it is constituted so that the actuation signal corresponding to the signal RM may be supplied to a system controller 101.

[0050] Moreover, the broadcast signal (RF modulating signal) by which the television receiver 100 was caught with a receiving antenna 105 and this receiving antenna 105 is supplied. The tuner 106 which acquires the SD signal Va (525i signals) which mentioned above by performing channel

selection processing, intermediate frequency magnification processing, detection processing, etc., The external input terminal 107 which inputs the SD signal Vb (525i signals) from the exterior, It has the change-over switch 108 which outputs alternatively either of these SD signals Va and Vb, and the buffer memory 109 for saving temporarily SD signal outputted from this change-over switch 108.

[0051] The SD signal Va outputted from a tuner 106 is supplied to the fixed-end child by the side of a of a change-over switch 108, and the SD signal Vb inputted from the external input terminal 107 is supplied to the fixed-end child by the side of b of a change-over switch 108. Switch actuation of this change-over switch 108 is controlled by the system controller 101.

[0052] Moreover, the picture signal processing section 110 which changes into HD signal (525p signals or 1050i signals) SD signal (525i signals) with which the television receiver 100 is saved temporarily at buffer memory 109, The display section 111 which displays the image by HD signal outputted from this picture signal processing section 110, The OSD (On Screen Display) circuit 112 for generating the status signal SCH for displaying an alphabetic character graphic form etc. on the screen of this display section 111, It has the synthetic vessel 113 for compounding the status signal SCH to HD signal outputted from the picture signal processing section 110 mentioned above, and supplying it to the display section 111.

[0053] The display section 111 consists of flat-panel displays, such as for example, a CRT (cathode-ray tube) display or LCD (liquid crystal display). Moreover, generating actuation of the status signal SCH in the OSD circuit 112 is controlled by the system controller 101.

[0054] Actuation of the television receiver 100 shown in drawing 1 is explained. When the mode in which image display corresponding to the SD signal Va outputted from a tuner 106 by actuation of a user's remote control transmitter 200 is performed is chosen, a change-over switch 108 is connected to the a side, and the SD signal Va is outputted by control of a system controller 101 from this change-over switch 108. When the mode in which image display corresponding to the SD signal Vb inputted into the external input terminal 107 by actuation of a user's remote control transmitter

200 is performed on the other hand is chosen, a change-over switch 108 is connected to the b side, and the SD signal Vb is outputted by control of a system controller 101 from this change-over switch 108.

[0055] SD signal (525i signals) outputted from a change-over switch 108 is memorized by buffer memory 109, and is saved temporarily. And SD signal saved temporarily at this buffer memory 109 is supplied to the picture signal processing section 110, and is changed into HD signal (525p signals or 1050i signals). That is, in the picture signal processing section 110, the pixel data (henceforth "HD pixel data") which constitute HD signal are obtained from the pixel data (henceforth "SD pixel data") which constitute SD signal. Here, selection of 525p signals or 1050i signals is performed by actuation of a user's remote control transmitter 200. HD signal outputted from this picture signal processing section 110 is supplied to the display section 111 through the synthetic vessel 113, and the image by that HD signal is displayed on the screen of the display section 111.

[0056] moreover -- not mentioning above, either -- a user can adjust smoothly the horizontal and vertical resolution of the image displayed to have mentioned above by actuation of the remote control transmitter 200 on the screen of the display section 111 to a stepless story. Although HD pixel data are computed by the presumed type in the picture signal processing section 110 so that it may mention later, the thing corresponding to the parameters h and v which determine the horizontal and vertical resolution adjusted by actuation of a user's remote control transmitter 200 as these presumed-type multiplier data is generated and used by the generation type containing these parameters h and v. Thereby, the horizontal and vertical resolution of the image by HD signal outputted from the picture signal processing section 110 becomes a thing corresponding to the adjusted parameters h and v.

[0057] Drawing 2 shows an example of the user interface for adjusting Parameters h and v. At the time of adjustment, an OSD indication of the adjustment screen 115 which showed the adjustment position of Parameters h and v to the display section 111 by icon 115a of * mark is given. Moreover, the remote control transmitter 200 is equipped with joy stick 200a as a user actuation means.

[0058] By operating joy stick 200a, a user can move the location of icon 115a on the adjustment screen 115, and can adjust the value of the parameters h and v which determine horizontal and vertical resolution to arbitration.

Drawing 3 expands and shows the part of the adjustment screen 115. The value of the parameter h which determines horizontal resolution by icon 115a being moved to right and left is adjusted, and the value of the parameter v which determines vertical definition by on the other hand icon 115a being moved up and down is adjusted. A user can adjust the value of Parameters h and v with reference to the adjustment screen 115 displayed on the display section 111, and can perform the adjustment easily.

[0059] In addition, the remote control transmitter 200 may be equipped with the pointing device of others, such as a mouse and a trackball, instead of joy stick 200a. Furthermore, the digital readout of the value of the parameters h and v adjusted by the user may be carried out on the adjustment screen 115.

[0060] Next, the detail of the picture signal processing section 110 is explained. the 1- which this picture signal processing section 110 takes out alternatively the data of two or more SD pixels located around the attention pixel concerning HD signal (1050i signals or 525p signals) from SD signal (525i signals) memorized by buffer memory 109, and is outputted -- it has the 3rd tap selection circuitry 121-123.

[0061] The 1st tap selection circuitry 121 takes out alternatively the data of SD pixel (a "prediction tap" is called) used for prediction. The 2nd tap selection circuitry 122 takes out alternatively the data of SD pixel (a "space class tap" is called) used for the class classification corresponding to the level distribution pattern of SD pixel data. The 3rd tap selection circuitry 123 takes alternatively the data of SD pixel (a "motion class tap" is called) used for the class classification corresponding to a motion, comes out, and carries out. In addition, when determining a space class using SD pixel data belonging to two or more fields, it will move also to this space class and information will be included.

[0062] Drawing 4 shows the pixel physical relationship of the odd number (o) field of a certain frame (F) of 525i signals and 525p signals. A big dot is the pixel of 525i signals, and it is the pixel of 525p signals with which a small dot

is outputted. In the even number (e) field, Rhine of 525i signals becomes what shifted 0.5 lines spatially. As pixel data of 525p signals, the Rhine data L1 of the same location as Rhine of 525i signals and the Rhine data L2 of the mid-position of Rhine of the upper and lower sides of 525i signals exist so that drawing 4 may show. Moreover, the number of pixels of each Rhine of 525p signals is twice the number of pixels of each Rhine of 525i signals.

[0063] Drawing 5 shows the pixel physical relationship of a frame (F) with 525i signals and 1050i signals, shows the pixel location of the odd number (o) field as a continuous line, and shows the pixel location of the even number (e) field with the broken line. A big dot is the pixel of 525i signals, and it is the pixel of 1050i signals with which a small dot is outputted. As pixel data of 1050i signals, the Rhine data L1 of a location near Rhine of 525i signals, L1', and the Rhine data L2 of a location far from Rhine of 525i signals and L2' exist so that drawing 5 may show. Here, the Rhine data of the odd number field, L1', and L2' are L1, and L2 are the Rhine data of the even number field. Moreover, the number of pixels of each Rhine of 1050i signals is twice the number of pixels of each Rhine of 525i signals.

[0064] Drawing 6 and drawing 7 show the example of the prediction tap (SD pixel) chosen by the 1st tap selection circuitry 121, when changing into 525p signals from 525i signals. Drawing 6 and drawing 7 show the pixel physical relationship of the perpendicular direction of the field of frame F-1 and F which continue in time, the odd number (o) of F+1, and even number (e).

[0065] As shown in drawing 6, the prediction tap when predicting the Rhine data L1 and L2 of field F/o As opposed to the pixel (attention pixel) of 525p signals which it is contained in following field F/e and should be created spatially The SD pixels T1 and T2 of the near location, and T3, SD pixel T four of the near location, and T5 and T6, as opposed to the pixel of 525p signals which it is contained in field F/o and should be created spatially It is the SD pixel T10 of a location spatially soon to the pixel of 525p signals which it is further contained spatially in front field F-1 / o with the SD pixels T7, T8, and T9 of the near location, and should be created to the pixel of 525p signals which it is contained in front field F-1 / e, and should be created.

[0066] As shown in drawing 7, the prediction tap when predicting the Rhine

data L1 and L2 of field F/e As opposed to the pixel of 525p signals which it is contained in the following field F+1/o, and should be created spatially The SD pixels T1 and T2 of the near location, and T3, SD pixel T four of the near location, and T5 and T6, as opposed to the pixel of 525p signals which it is contained in field F/e and should be created spatially It is the SD pixel T10 of a location spatially soon to the pixel of 525p signals which it is further contained spatially in front F-1/e with the SD pixels T7, T8, and T9 of the near location, and should be created to the pixel of 525p signals which it is contained in front field F/o and should be created.

[0067] In addition, in case the Rhine data L1 are predicted, it is made not to choose the SD pixel T9 as a prediction tap, and in case the Rhine data L2 are predicted on the other hand, you may make it not choose SD pixel T four as a prediction tap.

[0068] Drawing 8 and drawing 9 show the example of the prediction tap (SD pixel) chosen by the 1st tap selection circuitry 121, when changing into 1050i signals from 525i signals. Drawing 8 and drawing 9 show the pixel physical relationship of the perpendicular direction of the field of frame F-1 and F which continue in time, the odd number (o) of F+1, and even number (e).

[0069] As shown in drawing 8 , the prediction tap when predicting the Rhine data L1 and L2 of field F/o As opposed to the pixel (attention pixel) of 1050i signals which it is contained in following field F/e and should be created spatially The SD pixels T1 and T2 of the near location, They are the SD pixels T7 and T8 of a location spatially soon to the pixel of 1050i signals which it is contained in field F/o, will be spatially contained in SD pixel T3 of a location, T four, T5 and T6, and front field F-1 / e soon to the pixel of 525p signals which should be created, and should be created.

[0070] As shown in drawing 9 , the prediction tap when predicting Rhine data L1' of field F/e, and L2' As opposed to the pixel of 1050ip signals which it is contained in the following field F+1/o, and should be created spatially The SD pixels T1 and T2 of the near location, They are the SD pixels T7 and T8 of a location spatially soon to the pixel of 525p signals which it is contained in field F/e, will be spatially contained in SD pixel T3 of a location, T four, T5 and T6, and front field F/o soon to the pixel of 1050i signals which should be created,

and should be created.

[0071] In addition, in case the Rhine data L1 and L1' are predicted, it is made not to choose the SD pixel T6 as a prediction tap, and in case the Rhine data L2 and L2' are predicted on the other hand, you may make it not choose SD pixel T3 as a prediction tap.

[0072] Furthermore, you may make it choose horizontal 1 or two or more horizontal SD pixels as a prediction tap in addition to SD pixel which is in the same location of two or more fields as shown in drawing 6 - drawing 9 .

[0073] Drawing 10 and drawing 11 show the example of the space class tap (SD pixel) chosen by the 2nd tap selection circuitry 122, when changing into 525p signals from 525i signals. Drawing 10 and drawing 11 show the pixel physical relationship of the perpendicular direction of the field of frame F-1 and F which continue in time, the odd number (o) of F+1, and even number (e).

[0074] As shown in drawing 10 , the space class tap when predicting the Rhine data L1 and L2 of field F/o As opposed to the pixel (attention pixel) of 525p signals which it is contained in following field F/e and should be created spatially The SD pixels T1 and T2 of the near location, They are the SD pixels T6 and T7 of a location spatially soon to the pixel of 525p signals which it is contained in field F/o, will be spatially contained in SD pixel T3 of a location, T four, T5, and front field F-1 / e soon to the pixel of 525p signals which should be created, and should be created.

[0075] As shown in drawing 11 , the space class tap when predicting the Rhine data L1 and L2 of field F/e As opposed to the pixel of 525p signals which it is contained in the following field F+1/o, and should be created spatially The SD pixels T1 and T2 of the near location, They are the SD pixels T6 and T7 of a location spatially soon to the pixel of 525p signals which it is contained in field F/e, will be spatially contained in SD pixel T3 of a location, T four, T5 and T6, and front field F/o soon to the pixel of 525p signals which should be created, and should be created.

[0076] In addition, in case the Rhine data L1 are predicted, it is made not to choose the SD pixel T7 as a space class tap, and in case the Rhine data L2 are predicted on the other hand, you may make it not choose the SD pixel T6

as a space class tap.

[0077] Drawing 12 and drawing 13 show the example of the space class tap (SD pixel) chosen by the 2nd tap selection circuitry 122, when changing into 1050i signals from 525i signals. Drawing 12 and drawing 13 show the pixel physical relationship of the perpendicular direction of the field of frame F-1 and F which continue in time, the odd number (o) of F+1, and even number (e).

[0078] As shown in drawing 12, the space class tap when predicting the Rhine data L1 and L2 of field F/o As opposed to the pixel (attention pixel) of 1050i signals which it is contained in field F/o and should be created spatially. The SD pixels T1 and T2 of the near location, and T3, It is SD pixel T four of a location, and T5, T6 and T7 spatially soon to the pixel of 1050i signals which it is contained in front field F-1 / e, and should be created.

[0079] As shown in drawing 13, the space class taps when predicting Rhine data L1' of field F/e and L2' are SD pixel T four of a location, and T5, T6 and T7 spatially soon to the pixel of 1050i signals which it is contained in field F/e, will be spatially contained in the SD pixels T1 and T2 of a location, T3, and front field F/o soon to the pixel of 1050i signals which should be created, and should be created.

[0080] In addition, in case the Rhine data L1 and L1' are predicted, it is made not to choose the SD pixel T7 as a space class tap, and in case the Rhine data L2 and L2' are predicted on the other hand, you may make it not choose SD pixel T four as a space class tap.

[0081] Furthermore, you may make it choose horizontal 1 or two or more horizontal SD pixels as a space class tap in addition to SD pixel which is in the same location of two or more fields as shown in drawing 10 - drawing 13.

[0082] Drawing 14 shows the example of the motion class tap (SD pixel) chosen by the 3rd tap selection circuitry 123, when changing into 525p signals from 525i signals. Drawing 14 shows the pixel physical relationship of the perpendicular direction of the field of frame F-1 and the odd number (o) of F which continue in time, and even number (e). As shown in drawing 14, the motion class tap when predicting the Rhine data L1 and L2 of field F/o As opposed to the pixel (attention pixel) of 525p signals which it is contained in

following field F/e and should be created spatially The SD pixels n2, n4, and n6 of the near location, As opposed to the pixel of 525p signals which it is contained in field F/o and should be created spatially The SD pixels n1, n3, and n5 of the near location, As opposed to the pixel of 525p signals which it is contained in front field F-1 / e, and should be created spatially The SD pixels m2, m4, and m6 of the near location, They are the SD pixels m1, m3, and m5 of a location spatially soon to the pixel of 525p signals which it is furthermore contained in front field F-1 / o, and should be created. The location of the location of each perpendicular direction of the SD pixels n1-n6 of each perpendicular direction of the SD pixels m1-m6 corresponds.

[0083] Drawing 15 shows the example of the motion class tap (SD pixel) chosen by the 3rd tap selection circuitry 123, when changing into 1050i signals from 525i signals. Drawing 15 shows the pixel physical relationship of the perpendicular direction of the field of frame F-1 and the odd number (o) of F which continue in time, and even number (e). As shown in drawing 15 , the motion class tap when predicting the Rhine data L1 and L2 of field F/o As opposed to the pixel of 1050i signals which it is contained in following field F/e and should be created spatially The SD pixels n2, n4, and n6 of the near location, As opposed to the pixel of 1050i signals which it is contained in field F/o and should be created spatially The SD pixels n1, n3, and n5 of the near location, As opposed to the pixel of 1050i signals which it is contained in front field F-1 / e, and should be created spatially The SD pixels m2, m4, and m6 of the near location, They are the SD pixels m1, m3, and m5 of a location spatially soon to the pixel of 1050i signals which it is furthermore contained in front field F-1 / o, and should be created. The location of the location of each perpendicular direction of the SD pixels n1-n6 of each perpendicular direction of the SD pixels m1-m6 corresponds.

[0084] It returns to drawing 1 , and the picture signal processing section 110 detects the level distribution pattern of the data (SD pixel data) of a space class tap alternatively taken out by the 2nd tap selection circuitry 122, a space class is detected based on this level distribution pattern, and it has the space class detector 124 which outputs that class information.

[0085] In the space class detector 124, an operation which compresses each

SD pixel data into 2 bit data from 8 bit data is performed, for example. And from the space class detector 124, the compressed data corresponding to each SD pixel data is outputted as class information on a space class. A data compression is performed by ADRC (Adaptive Dynamic Range Coding) in the gestalt of this operation. In addition, as an information-compression means, DPCM (predicting coding), VQ (vector quantization), etc. may be used in addition to ADRC.

[0086] Originally, although it is the adaptation re-quantizing method which turned and was developed for high performance coding VTR (Video Tape Recorder), since ADRC can express the local pattern of signal level efficiently by the short word length, it is used for the data compression mentioned above, and is suitable. If maximum of the data (SD pixel data) of a space class tap is set to MAX and DR (= MAX-MIN +1) and a re-quantifying bit number are set [the minimum value] to P for the dynamic range of the data of MIN and a space class tap when using ADRC, the re-quantization code q_i as compressed data will be obtained by the operation of (1) type to each SD pixel data k_i as data of a space class tap. However, in (1) type, [] means cut-off processing. As data of a space class tap, when there are SD pixel data of N_a individual, they are $i = 1 - N_a$.

$$q_i = [(k_i - \text{MIN} + 0.5) \cdot 2^P / \text{DR}] \dots (1)$$

[0087] Moreover, the picture signal processing section 110 detects the motion class for mainly expressing extent of a motion with the 3rd tap selection circuitry 123 from the data (SD pixel data) of a motion class tap taken out alternatively, and has the motion class detector 125 which outputs the class information.

[0088] inter-frame [from the data (SD pixel data) m_i and n_i of a motion class tap alternatively taken out by the 3rd tap selection circuitry 123 in this motion class detector 125] -- difference is computed, threshold processing is further performed to the average of the absolute value of that difference, and the motion class which is the index of a motion is detected. That is, the average AV of the absolute value of difference is computed by (2) types in the motion class detector 125. It is the 3rd tap selection circuitry 123, for example, as mentioned above, when 12 SD pixel data m_1 - m_6 , and n_1 - n_6 are taken out,

Nb in (2) types is 6.

[0089]

[Equation 1]

$$A V = \frac{\sum_{i=1}^{Nb} |m_i - n_i|}{Nb} \quad \cdot \cdot \cdot (2)$$

[0090] And the average AV computed as mentioned above is compared with one piece or two or more thresholds, and moves by the motion class detector 125, and the class information MV on a class is acquired in it. For example, when the thresholds th1, th2, and th3 (th1<th2<th3) of three pieces are prepared and it detects four motion classes, it is made into MV=3 at the time of MV=2 and th3<AV at the time of MV=1 and th2<AV<=th3 at the time of MV=0 and th1<AV<=th2 at the time of AV<=th1.

[0091] Moreover, the picture signal processing section 110 has a class composition circuit 126 for obtaining the class code CL which shows the class to which the pixel (attention pixel) of the re-quantization code qi as class information on the space class outputted from the space class detector 124 and HD signal (525p signals or 1050i signals) which should be created based on the class information MV on the motion class outputted from the motion class detector 125 belongs.

[0092] The operation of the class code CL is performed by (3) types in this class composition circuit 126. In addition, in (3) types, the re-quantifying bit number [in / Na, and / in P / ADRC] is shown. [the number of the data (SD pixel data) of a space class tap]

[0093]

[Equation 2]

$$C L = \sum_{i=1}^{Na} q_i (2^P)^i + MV \cdot 2^{P^{Na}} \quad \cdot \cdot \cdot (3)$$

[0094] Moreover, the picture signal processing section 110 has registers 130-133 and a coefficient memory 134. The line sequential conversion circuit 129 mentioned later is with the case where 525p signals are outputted, and the case where 1050i signals are outputted, and needs to switch the actuation. A

register 130 stores the assignment information of operation that actuation of the line sequential conversion circuit 129 is specified. The line sequential conversion circuit 129 carries out actuation according to the assignment information of operation supplied from a register 130.

[0095] A register 131 stores the tap positional information of the prediction tap chosen by the 1st tap selection circuitry 121. The 1st tap selection circuitry 121 chooses a prediction tap according to the tap positional information supplied from a register 131. The number of SD pixel which assigns a number to tap positional information to two or more SD pixels which may be chosen, for example, and is chosen is specified. Also in the following tap positional information, it is the same.

[0096] A register 132 stores the tap positional information of the space class tap chosen by the 2nd tap selection circuitry 122. The 2nd tap selection circuitry 122 chooses a space class tap according to the tap positional information supplied from a register 132.

[0097] Here, the tap positional information A when a motion is comparatively small, and the tap positional information B when a motion is comparatively large are stored in a register 132. It is chosen by the class information MV on the motion class outputted from the motion class detector 125 any of these tap positional information A and B are supplied to the 2nd tap selection circuitry 122.

[0098] That is, since the motion is small, when it is $MV=0$ or $MV=1$, as there is no motion, or the tap positional information A is supplied to the 2nd tap selection circuitry 122 and the space class tap chosen by this 2nd tap selection circuitry 122 is shown in drawing 10 - drawing 13, two or more fields shall be straddled. moreover, the space class tap as which the tap positional information B is supplied to the 2nd tap selection circuitry 122, and is chosen by this 2nd tap selection circuitry 122 when it is $MV=2$ or $MV=3$, since the motion is comparatively large -- not illustrating, either -- it considers only as SD pixel in the same field as the pixel which should be created.

[0099] In addition, tap positional information when a motion is comparatively small, and tap positional information when a motion is comparatively large are stored also in the register 131 mentioned above, and you may make it chosen

by the class information MV on the motion class which the tap positional information supplied to the 1st tap selection circuitry 121 moves, and is outputted from the class detector 125.

[0100] A register 133 stores the tap positional information of the motion class tap chosen by the 3rd tap selection circuitry 123. The 3rd tap selection circuitry 123 moves according to the tap positional information supplied from a register 133, and chooses a class tap.

[0101] Furthermore, a coefficient memory 134 stores the presumed-type multiplier data used in the presumed prediction arithmetic circuit 127 mentioned later for every class. This multiplier data is the information for changing 525i signals as an SD signal into 525p signals or 1050i signals as an HD signal. The class code CL outputted to a coefficient memory 134 from the class composition circuit 126 mentioned above reads, it will be supplied as address information, the multiplier data corresponding to the class code CL will be read from this coefficient memory 134, and the presumed prediction arithmetic circuit 127 will be supplied.

[0102] Moreover, the picture signal processing section 110 has the information memory bank 135. The assignment information of operation for storing in a register 130 and the tap positional information for storing in registers 131-133 are beforehand stored in this information memory bank 135.

[0103] Here, the 1st assignment information of operation for operating the line sequential conversion circuit 129 so that 525p signals may be outputted, and the 2nd assignment information of operation for operating the line sequential conversion circuit 129 so that 1050i signals may be outputted are beforehand stored in the information memory bank 135 as assignment information of operation for storing in a register 130.

[0104] A user is operating the remote control transmitter 200, and can choose the 1st conversion approach which outputs 525p signals as an HD signal, or the 2nd conversion approach which outputs 1050i signals as an HD signal. The selection information of that conversion approach is supplied to the information memory bank 135 from a system controller 101, and the 1st assignment information of operation or the 2nd assignment information of operation is loaded to a register 130 according to that selection information

from this information memory bank 135.

[0105] Moreover, the 1st tap positional information corresponding to the 1st conversion approach (525p) and the 2nd tap positional information corresponding to the 2nd conversion approach (1050i) are beforehand stored in the information memory bank 135 as tap positional information of the prediction tap for storing in a register 131. According to the selection information of the conversion approach mentioned above, the 1st tap positional information or the 2nd tap positional information is loaded to a register 131 from this information memory bank 135.

[0106] Moreover, the 1st tap positional information corresponding to the 1st conversion approach (525p) and the 2nd tap positional information corresponding to the 2nd conversion approach (1050i) are beforehand stored in the information memory bank 135 as tap positional information of the space class tap for storing in a register 132. In addition, the 1st and 2nd tap positional information consists of tap positional information when a motion is comparatively small respectively, and tap positional information when a motion is comparatively large. According to the selection information of the conversion approach mentioned above, the 1st tap positional information or the 2nd tap positional information is loaded to a register 132 from this information memory bank 135.

[0107] Moreover, the 1st tap positional information corresponding to the 1st conversion approach (525p) and the 2nd tap positional information corresponding to the 2nd conversion approach (1050i) are beforehand stored in the information memory bank 135 as tap positional information of the motion class tap for storing in a register 133. According to the selection information of the conversion approach mentioned above, the 1st tap positional information or the 2nd tap positional information is loaded to a register 133 from this information memory bank 135.

[0108] Moreover, the multiplier kind data of each class corresponding to each of the 1st and 2nd conversion approaches are beforehand stored in the information memory bank 135. This multiplier kind data is generation-type multiplier data for generating the multiplier data for storing in the coefficient memory 134 mentioned above.

[0109] In the presumed prediction arithmetic circuit 127 mentioned later, HD pixel data y which should be created calculate by the presumed type of (4) types from the data (SD pixel data) xi of a prediction tap, and the multiplier data Wi read from a coefficient memory 134. As shown in drawing 4 and drawing 7 , when the number of the prediction taps chosen by the 1st tap selection circuitry 121 is ten, n in (4) types is set to 10.

[0110]

[Equation 3]

$$y = \sum_{i=1}^n W_i \cdot x_i \quad \cdot \cdot \cdot (4)$$

[0111] And these presumed-type multiplier data Wi (i=1-n) are generated by the generation type containing Parameters h and v as shown in (5) types. The multiplier kind data w10-wn9 which are these generation-type multiplier data are memorized for every conversion approach and every class by the information memory bank 135. About the generation method of this multiplier kind data, it mentions later.

[0112]

[Equation 4]

$$W_1 = w_{10} + w_{11}v + w_{12}h + w_{13}v^2 + w_{14}v h + w_{15}h^2 \\ + w_{16}v^3 + w_{17}v^2 h + w_{18}v h^2 + w_{19}h^3$$

$$W_2 = w_{20} + w_{21}v + w_{22}h + w_{23}v^2 + w_{24}v h + w_{25}h^2 \\ + w_{26}v^3 + w_{27}v^2 h + w_{28}v h^2 + w_{29}h^3$$

⋮

$$W_i = w_{i0} + w_{i1}v + w_{i2}h + w_{i3}v^2 + w_{i4}v h + w_{i5}h^2 \\ + w_{i6}v^3 + w_{i7}v^2 h + w_{i8}v h^2 + w_{i9}h^3$$

⋮

$$W_n = w_{n0} + w_{n1}v + w_{n2}h + w_{n3}v^2 + w_{n4}v h + w_{n5}h^2 \\ + w_{n6}v^3 + w_{n7}v^2 h + w_{n8}v h^2 + w_{n9}h^3$$

⋮ ⋮ ⋮ (5)

[0113] Moreover, the picture signal processing section 110 has the multiplier

generation circuit 136 which generates the presumed-type multiplier data W_i ($i=1-n$) corresponding to the value of Parameters h and v for every class by (5) types using the value of the multiplier kind data of each class, and Parameters h and v . According to the selection information of the conversion approach mentioned above, the multiplier kind data of each class corresponding to the 1st conversion approach or the 2nd conversion approach are loaded to this multiplier generation circuit 136 from the information memory bank 135. Moreover, the value of Parameters h and v is supplied to this multiplier generation circuit 136 from a system controller 101.

[0114] The multiplier data W_i ($i=1-n$) of each class generated in this multiplier generation circuit 136 are stored in the coefficient memory 134 mentioned above. Generation of the multiplier data W_i of each class in this multiplier generation circuit 136 is performed for example, in each perpendicular blanking period. Thereby, even if the value of Parameters h and v is changed by actuation of a user's remote control transmitter 200, the multiplier data W_i of each class stored in a coefficient memory 134 can be immediately changed into the thing corresponding to the value of the parameters h and v , and adjustment of the resolution by the user is performed smoothly.

[0115] Moreover, the picture signal processing section 110 has the normalization coefficient memory 138 which stores the normalization multiplier generation circuit 137 which calculates the normalization multiplier S corresponding to the multiplier data W_i ($i=1-n$) of each class generated in the multiplier generation circuit 136 by (6) types, and the normalization multiplier S generated here for every class. The class code CL outputted to the normalization coefficient memory 138 from the class composition circuit 126 mentioned above reads, it will be supplied as address information, the normalization multiplier S corresponding to the class code CL will be read from this normalization coefficient memory 138, and the normalized-arithmetic circuit 128 mentioned later will be supplied.

[0116]

[Equation 5]

$$S = \sum_{i=1}^n W_i \quad \cdot \cdot \cdot \quad (6)$$

[0117] Moreover, the picture signal processing section 110 has the presumed prediction arithmetic circuit 127 which calculates the data of the pixel (attention pixel) of HD signal which should be created from the data (SD pixel data) x_i of a prediction tap alternatively taken out by the 1st tap selection circuitry 121, and the multiplier data W_i read from a coefficient memory 134.

[0118] When outputting 525p signals, as shown in drawing 4 mentioned above, it is necessary to generate the Rhine data L1 of the same location as Rhine of 525i signals, and the Rhine data L2 of the mid-position of Rhine of the upper and lower sides of 525i signals, and to make the number of pixels of each Rhine into twice in the odd number (o) field and the even number (e) field, in this presumed prediction arithmetic circuit 127. Moreover, when outputting 1050i signals, as shown in drawing 5 mentioned above, it is necessary to generate the Rhine data L1 of a location near Rhine of 525i signals, L1', and the Rhine data L2 of a location far from Rhine of 525i signals and L2', and to make the number of pixels of each Rhine into twice in the odd number (o) field and the even number (e) field, in this presumed prediction arithmetic circuit 127.

[0119] Therefore, in the presumed prediction arithmetic circuit 127, the 4-pixel data which constitute HD signal are generated instantaneous. For example, 4-pixel data are generated instantaneous using the presumed type which differs in multiplier data, respectively, and each presumed-type multiplier data are supplied from a coefficient memory 134. here -- presumption -- prediction -- an arithmetic circuit -- 127 -- **** -- prediction -- a tap -- data (SD pixel data) -- x_i -- a coefficient memory -- 134 -- reading -- having -- a multiplier -- data -- W_i -- from -- a **** -- (-- four --) -- a formula -- presumption -- a formula -- it should create -- HD -- a pixel -- data -- y -- calculating -- having .

[0120] Moreover, the picture signal processing section 110 has the normalized-arithmetic circuit 128 which does the division of each HD pixel data y which constitutes the Rhine data L1 and L2 (L1', L2') outputted from the presumed prediction arithmetic circuit 127 by the normalization multiplier S corresponding to the multiplier data W_i ($i=1-n$) which were read from the normalization coefficient memory 138 and used for each generation, and

normalizes. not mentioning above, either -- although it asks for presumed-type multiplier data by the generation formula from multiplier kind data in the multiplier generation circuit 136, it is not guaranteed that, as for the multiplier data generated, total of the multiplier data W_i ($i=1-n$) is set to 1.0 including a rounding error. Therefore, HD pixel data y calculated in the presumed prediction arithmetic circuit 127 become what carried out level variation according to the rounding error. As mentioned above, the fluctuation is removable by normalizing in the normalized-arithmetic circuit 128.

[0121] Moreover, the picture signal processing section 110 performs the Rhine **** processing which makes a level period $1/2$, and has the line sequential conversion circuit 129 which makes line sequential the Rhine data $L1$ and $L2$ ($L1'$, $L2'$) supplied through the normalization arithmetic circuit 128 from the presumed prediction arithmetic circuit 127.

[0122] Drawing 16 shows the Rhine **** processing in the case of outputting 525p signals using an analog wave. As mentioned above, the Rhine data $L1$ and $L2$ are generated by the presumed prediction arithmetic circuit 127. Rhine of $a1$, $a2$, $a3$, and ... is included in the Rhine data $L1$ in order, and Rhine of $b1$, $b2$, $b3$, and ... is included in the Rhine data $L2$ in order. The line sequential conversion circuit 129 forms the line sequential outputs $a0$, $b0$, $a1$, and $b1$ and ... by compressing the data of each Rhine one half at time amount shaft orientations, and choosing the compressed data by turns.

[0123] In addition, in outputting 1050i signals, the line sequential conversion circuit 129 generates a line sequential output so that interlace relation may be filled in the odd number field and the even number field. Therefore, the line sequential conversion circuit 129 is with the case where 525p signals are outputted, and the case where 1050i signals are outputted, and needs to switch the actuation. The assignment information of operation is supplied from a register 130, as mentioned above.

[0124] Next, actuation of the picture signal processing section 110 is explained.

[0125] The data (SD pixel data) of a space class tap are alternatively taken out from SD signal (525i signals) memorized by buffer memory 109 by the 2nd tap selection circuitry 122. In this case, in the 2nd tap selection circuitry

122, selection of a tap is performed based on the tap positional information corresponding to the conversion approach which is supplied from a register 132 and which was chosen by the user, and the motion class detected in the motion class detector 125.

[0126] The data (SD pixel data) of a space class tap alternatively taken out by this 2nd tap selection circuitry 122 are supplied to the space class detector 124. In this space class detector 124, ADRC processing is performed to each SD pixel data as data of a space class tap, and the re-quantization code q_i as class information on a space class (mainly class classification for the wave expression in space) is obtained (refer to (1) type).

[0127] Moreover, the data (SD pixel data) of a motion class tap are alternatively taken out from SD signal (525i signals) memorized by buffer memory 109 by the 3rd tap selection circuitry 123. In this case, in the 3rd tap selection circuitry 123, selection of a tap is performed based on the tap positional information corresponding to the conversion approach which is supplied from a register 133 and which was chosen by the user.

[0128] The data (SD pixel data) of a motion class tap alternatively taken out by this 3rd tap selection circuitry 123 are supplied to the motion class detector 125. It moves by this motion class detector 125 from each SD pixel data as data of a motion class tap, and the class information MV on a class (class classification for mainly expressing extent of a motion) is acquired in it.

[0129] This motion information MV and the re-quantization code q_i mentioned above are supplied to the class composition circuit 126. In this class composition circuit 126, the class code CL which shows the class to which the pixel (attention pixel) of HD signal (525p signals or 1050i signals) which should be created belongs is obtained from these motion information MV and the re-quantization code q_i (refer to (3) types). And this class code CL is read to a coefficient memory 134 and the normalization coefficient memory 138, and is supplied as address information.

[0130] The presumed-type multiplier data W_i ($i=1-n$) of each class corresponding to the value of the parameters h and v adjusted by the user are generated and stored in a coefficient memory 134 in the multiplier generation circuit 136 at each perpendicular blanking period. Moreover, the normalization

multiplier S corresponding to the multiplier data W_i ($i=1-n$) of each class generated in the multiplier generation circuit 136 as mentioned above is generated and stored in the normalization coefficient memory 138 in the normalization multiplier generation circuit 137.

[0131] By the class code CL reading and being supplied as address information, as mentioned above to the coefficient memory 134, the multiplier data W_i corresponding to the class code CL are read from this coefficient memory 134, and the presumed prediction arithmetic circuit 127 is supplied. Moreover, the data (SD pixel data) of a prediction tap are alternatively taken out from SD signal ($525i$ signals) memorized by buffer memory 109 by the 1st tap selection circuitry 121. In this case, in the 1st tap selection circuitry 121, selection of a tap is performed based on the tap positional information corresponding to the conversion approach which is supplied from a register 131 and which was chosen by the user. The data (SD pixel data) x_i of a prediction tap alternatively taken out by this 1st tap selection circuitry 121 are supplied to the presumed prediction arithmetic circuit 127.

[0132] In the presumed prediction arithmetic circuit 127, the data (HD pixel data) y of the pixel (attention pixel) of HD signal which should be created calculate from the data (SD pixel data) x_i of a prediction tap, and the multiplier data W_i read from a coefficient memory 134 (refer to (4) types). In this case, the 4-pixel data which constitute HD signal are generated instantaneous.

[0133] When the 1st conversion approach which outputs $525p$ signals is chosen by this, it is the odd number (o) field and the even number (e) field, and the Rhine data $L1$ of the same location as Rhine of $525i$ signals and the Rhine data $L2$ of the mid-position of Rhine of the upper and lower sides of $525i$ signals are generated (refer to drawing 4). Moreover, when the 2nd conversion approach which outputs $1050i$ signals is chosen, it is the odd number (o) field and the even number (e) field, and the Rhine data $L1$ of a location near Rhine of $525i$ signals, $L1'$, and the Rhine data $L2$ of a location far from Rhine of $525i$ signals and $L2'$ are generated (refer to drawing 5).

[0134] Thus, the Rhine data $L1$ and $L2$ ($L1'$, $L2'$) generated in the presumed prediction arithmetic circuit 127 are supplied to the normalized-arithmetic circuit 128. By the class code CL reading and being supplied as address

information, as mentioned above to the normalization coefficient memory 138. The normalization multiplier S corresponding to the class code CL from this normalization coefficient memory 138. That is, the normalization multiplier S corresponding to the multiplier data W_i ($i=1-n$) used for generation of each HD pixel data y which constitutes the Rhine data $L1$ and $L2$ ($L1'$, $L2'$) outputted from the presumed prediction arithmetic circuit 127 is read, and the presumed prediction arithmetic circuit 127 is supplied. In the normalization arithmetic circuit 128, by the normalization multiplier S which corresponds, respectively, the division of each HD pixel data y which constitutes the Rhine data $L1$ and $L2$ ($L1'$, $L2'$) outputted from the presumed prediction arithmetic circuit 127 is done, and it normalizes it. Thereby, the level variation of the information data of the observing point by the rounding error at the time of asking for presumed-type (referring to (4) types) multiplier data by the generation formula (referring to (5) types) using multiplier kind data is removed.

[0135] Thus, the Rhine data $L1$ and $L2$ ($L1'$, $L2'$) which it normalized in the normalization arithmetic circuit 128 are supplied to the line sequential conversion circuit 129. And in this line sequential conversion circuit 129, the Rhine data $L1$ and $L2$ ($L1'$, $L2'$) are made line sequential, and HD signal is generated. In this case, the line sequential conversion circuit 129 carries out actuation according to the movement directive information corresponding to the conversion approach which is supplied from a register 130 and which was chosen by the user. Therefore, when the 1st conversion approach (525p) is chosen by the user, 525p signals are outputted from the line sequential conversion circuit 129. On the other hand, when the 2nd conversion approach (1050i) is chosen by the user, 1050i signals are outputted from the line sequential conversion circuit 129.

[0136] As mentioned above, using the multiplier kind data loaded from the information memory bank 135, for every class, the presumed-type multiplier data W_i ($i=1-n$) corresponding to the value of Parameters h and v are generated, and this is stored in a coefficient memory 134 in the multiplier generation circuit 136. And HD pixel data y calculate from this coefficient memory 134 in the presumed prediction arithmetic circuit 127 using the multiplier data W_i ($i=1-n$) read corresponding to the class code CL .

[0137] Thus, in the picture signal processing section 110, the presumed-type multiplier data W_i ($i=1-n$) corresponding to the value of two or more kinds of adjusted parameters h and v are used, and HD pixel data y calculate.

Therefore, a user is adjusting the value of Parameters h and v , and can adjust the image quality of the image by HD signal freely with the shaft of horizontal resolution and vertical definition. Moreover, a user can adjust smoothly the horizontal and vertical image quality of the image by HD signal to a stepless story by adjusting the value of Parameters h and v . In addition, the multiplier data of each class corresponding to the value of the parameters h and v adjusted in this case are generated and used in the multiplier generation circuit 136 each time, and the memory which stores a lot of multiplier data is not needed.

[0138] As mentioned above, multiplier kind data are memorized by the information memory bank 135 for every conversion approach and every class. This multiplier kind data is beforehand generated by study.

[0139] First, an example of this generation method is explained. (5) The example which asks for the multiplier kind data $w_{10}-w_{n9}$ which are multiplier data in the generation type of a formula shall be shown.

[0140] Here, t_i ($i=0-9$) is defined like (7) types for the following explanation.

$t_0=1, t_1=v, t_2=h, t_3=v^2, t_4=vh, t_5=h^2, t_6=v^3, t_7=v^2h, t_8=vh^2, t_9=h^3 \dots$ (7)

If this (7) type is used, (5) types will be rewritten like (8) types.

[0141]

[Equation 6]

$$W_j = \sum_{i=0}^9 W_{ji} t_i \quad \cdot \cdot \cdot \quad (8)$$

[0142] Finally, it asks for an undetermined coefficient w_{xy} by study. Namely, the multiplier value which makes a square error min is determined using two or more SD pixel data and HD pixel data for every conversion approach and every class. It is a solution method by the so-called least square method. In the remainder [in / for the number of study / the study data of m and eye k ($1 \leq k \leq m$) watch], when total of ek and a square error is set to E , E is expressed with (9) types using (4) types and (5) types. Here, the k -th pixel

data [in / in x_{ik} / the i -th prediction tap location of SD image] and y_k express the pixel data of k -th HD image corresponding to it.

[0143]

[Equation 7]

$$\begin{aligned}
 E &= \sum_{k=1}^m e_k^2 \\
 &= \sum_{k=1}^m [y_k - (W_1 x_{1k} + W_2 x_{2k} + \dots + W_n x_{nk})]^2 \\
 &= \sum_{k=1}^m [y_k - [(t_0 w_{10} + t_1 w_{11} + \dots + t_9 w_{19}) x_{1k} + \dots \\
 &\quad \dots + (t_0 w_{n0} + t_1 w_{n1} + \dots + t_9 w_{n9}) x_{nk}]]^2 \\
 &= \sum_{k=1}^m [y_k - [(w_{10} + w_{11}v + \dots + w_{19}h^3) x_{1k} + \dots \\
 &\quad \dots + (w_{n0} + w_{n1}v + \dots + w_{n9}h^3) x_{nk}]]^2 \\
 &\quad \dots (9)
 \end{aligned}$$

[0144] In the solution method by the least square method, wxy from which the partial differential by wxy of (9) types is set to 0 is calculated. This is shown by (10) types.

[0145]

[Equation 8]

$$\frac{\partial E}{\partial w_{ij}} = \sum_{k=1}^m 2 \left(\frac{\partial e_k}{\partial w_{ij}} \right) e_k = - \sum_{k=1}^m 2 t_j x_{ik} e_k = 0$$

. . . (10)

[0146] Hereafter, a definition of X_{ipjq} and Y_{ip} rewrites (10) types like (13) types like (11) types and (12) types using a matrix.

[0147]

[Equation 9]

$$\begin{aligned}
 X_{ipjq} &= \sum_{k=1}^m x_{ik} t_p x_{jk} t_q \quad \dots (11) \\
 Y_{ip} &= \sum_{k=1}^m x_{ik} t_p y_k \quad \dots (12)
 \end{aligned}$$

[0148]

[Equation 10]

$$\begin{bmatrix}
 X_{1010} & X_{1011} & X_{1012} & \cdots & X_{1019} & X_{1020} & \cdots & X_{10n9} \\
 X_{1110} & X_{1111} & X_{1112} & \cdots & X_{1119} & X_{1120} & \cdots & X_{11n9} \\
 X_{1210} & X_{1211} & X_{1212} & \cdots & X_{1219} & X_{1220} & \cdots & X_{12n9} \\
 \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\
 X_{1910} & X_{1911} & X_{1912} & \cdots & X_{1919} & X_{1920} & \cdots & X_{19n9} \\
 X_{2010} & X_{2011} & X_{2012} & \cdots & X_{2019} & X_{2020} & \cdots & X_{20n9} \\
 \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\
 X_{n910} & X_{n911} & X_{n912} & \cdots & X_{n919} & X_{n920} & \cdots & X_{n9n9}
 \end{bmatrix}
 \begin{bmatrix}
 w_{10} \\
 w_{11} \\
 w_{12} \\
 \vdots \\
 w_{19} \\
 w_{20} \\
 \vdots \\
 w_{n9}
 \end{bmatrix}
 =
 \begin{bmatrix}
 Y_{10} \\
 Y_{11} \\
 Y_{12} \\
 \vdots \\
 Y_{19} \\
 Y_{20} \\
 \vdots \\
 Y_{n9}
 \end{bmatrix}
 \quad \cdots (13)$$

[0149] Generally this equation is called the normal equation. This normal equation is swept out, and is solved about wxy using law (method of elimination of Gauss-Jordan) etc., and multiplier kind data are computed.

[0150] Drawing 17 shows the concept of the generation method of the multiplier kind data mentioned above. Two or more SD signals are generated from HD signal. For example, adjustable [of the parameters h and v which carry out adjustable / of the level band and perpendicular band of the filter used in case SD signal is generated from HD signal] is carried out to nine steps, respectively, and a total of 81 kinds of SD signals are generated. Thus, it learns between two or more SD signals and HD signals which were generated, and multiplier kind data are generated.

[0151] Drawing 18 shows the configuration of the multiplier kind data generation equipment 150 which generates multiplier kind data with the concept mentioned above.

[0152] This multiplier kind data generation equipment 150 has the input terminal 151 into which HD signal (525p signals / 1050i signals) as a teacher signal is inputted, and SD signal generation circuit 152 which performs horizontal and vertical infanticide processing to this HD signal, and acquires SD signal as an input signal.

[0153] The conversion approach selection signal is supplied to this SD signal generation circuit 152 as a control signal. When the 1st conversion approach (525p signals are acquired from 525i signals in the picture signal processing

section 110 of drawing 1) is chosen, in SD signal generation circuit 152, infanticide processing is performed to 525p signals, and SD signal is generated (refer to drawing 4). On the other hand, when the 2nd conversion approach (1050i signals are acquired from 525i signals in the picture signal processing section 110 of drawing 1) is chosen, in SD signal generation circuit 152, infanticide processing is performed to 1050i signals, and SD signal is generated (refer to drawing 5).

[0154] Moreover, Parameters h and v are supplied to SD signal generation circuit 152 as a control signal. Corresponding to these parameters h and v, adjustable [of the level band and perpendicular band of a filter which are used in case SD signal is generated from HD signal] is carried out. Here, some examples are shown about the detail of a filter.

[0155] For example, it is possible to constitute from a band-pass filter which restricts a level band for a filter, and a band-pass filter which restricts a perpendicular band. In this case, as shown in drawing 19 , a 1-dimensional filter with the frequency characteristics corresponding to the gradual value of Parameters h or v can be obtained by designing the frequency characteristics corresponding to the gradual value of Parameters h or v, and carrying out an inverse Fourier transform.

[0156] Moreover, it is possible to constitute from a 1-dimensional Gaussian filter which restricts a level band for a filter, and a 1-dimensional Gaussian filter which restricts a perpendicular band for example. This 1-dimensional Gaussian filter is shown by (14) types. In this case, a 1-dimensional Gaussian filter with the frequency characteristics corresponding to the gradual value of Parameters h or v can be obtained by changing the value of standard deviation sigma gradually corresponding to the gradual value of Parameters h or v.

[0157]

[Equation 11]

$$O u t = \frac{1.0}{\sigma \sqrt{2.0 \pi}} e^{\frac{-(4.0x-37)^2}{2.0 \sigma^2}}$$

. . . (1 4)

[0158] Moreover, it is possible to constitute a filter from a two-dimensional filter $F(h, v)$ with which horizontal and vertical frequency characteristics are decided by both parameters h and v for example. The generation method of this two-dimensional filter can obtain a two-dimensional filter with the two-dimensional frequency characteristics corresponding to the gradual value of Parameters h and v by designing the two-dimensional frequency characteristics corresponding to the gradual value of Parameters h and v , and carrying out a two-dimensional inverse Fourier transform like the 1-dimensional filter mentioned above.

[0159] moreover, the 1- which multiplier kind data generation equipment 150 takes out alternatively the data of two or more SD pixels located around the attention pixel concerning HD signal (1050i signals or 525p signals) from SD signal (525i signals) outputted from SD signal generation circuit 152, and is outputted -- it has the 3rd tap selection circuitry 153-155.

[0160] these the 1- the 1- of the picture signal processing section 110 which the 3rd tap selection circuitry 153-155 mentioned above -- it is constituted like the 3rd tap selection circuitry 121-123. these the 1- the tap chosen by the 3rd tap selection circuitry 153-155 is specified by the tap positional information from the tap selection-control section 156.

[0161] The conversion approach selection signal is supplied to the tap selection-control circuit 156 as a control signal. the case where the case where the 1st conversion approach is chosen, and the 2nd conversion approach are chosen -- the 1- he is trying for the tap positional information supplied to the 3rd tap selection circuitry 153-155 to differ Moreover, the class information MV on the motion class outputted from the motion class detector 158 mentioned later is supplied to the tap selection-control circuit 156. It is made for whether the tap positional information of a motion supplied to the 2nd tap selection circuitry 154 is large to differ from whether it is small by this.

[0162] Moreover, multiplier kind data generation equipment 150 detects the level distribution pattern of the data (SD pixel data) of a space class tap alternatively taken out by the 2nd tap selection circuitry 154, detects a space class based on this level distribution pattern, and has the space class detector

157 which outputs that class information. This space class detector 157 is constituted like the space class detector 124 of the picture signal processing section 110 mentioned above. From this space class detector 157, the re-quantization code q_i for every SD pixel data as data of a space class tap is outputted as class information which shows a space class.

[0163] Moreover, multiplier kind data generation equipment 150 detects the motion class for mainly expressing extent of a motion with the 3rd tap selection circuitry 155 from the data (SD pixel data) of a motion class tap taken out alternatively, and has the motion class detector 158 which outputs the class information MV. This motion class detector 158 is constituted like the motion class detector 125 of the picture signal processing section 110 mentioned above. inter-frame [from the data (SD pixel data) of a motion class tap alternatively taken out by the 3rd tap selection circuitry 155 in this motion class detector 158] -- difference is computed, threshold processing is further performed to the average of the absolute value of that difference, and the motion class which is the index of a motion is detected.

[0164] Moreover, multiplier kind data generation equipment 150 has a class composition circuit 159 for obtaining the class code CL which shows the re-quantization code q_i as class information on the space class outputted from the space class detector 157, and the class to which the attention pixel concerning HD signal (525p signals or 1050i signals) belongs based on the class information MV on the motion class outputted from the motion class detector 158. It is constituted like [this class composition circuit 159] the class composition circuit 126 of the picture signal processing section 110 mentioned above.

[0165] Moreover, each HD pixel data y as attention pixel data obtained from HD signal with which multiplier kind data generation equipment 150 is supplied to an input terminal 151 The data x_i of a prediction tap alternatively taken out by the 1st tap selection circuitry 153 respectively corresponding to each of this HD pixel data y (SD pixel data), It has the normal equation generation section 160 which generates the normal equation (refer to (13) equations) for obtaining the multiplier kind data w_{10} - w_{n9} for every class from the class code CL outputted from the class composition circuit 159

respectively corresponding to each HD pixel data y .

[0166] In this case, although study data are generated in the combination of HD pixel data y of a piece, and n prediction tap pixel data corresponding to it. Sequential generation of two or more SD signals with which a sequential change of the parameters h and v to SD signal generation circuit 152 was made, and the horizontal and vertical band changed gradually is carried out, and, thereby, the normal equation with which many study data were registered is generated in the normal-equation generation section 160.

[0167] Here, the multiplier kind data learned and computed between HD signal and SD signal which the band made the narrow filter act and generated from the HD signal become a thing for acquiring HD signal with high resolution. On the contrary, the multiplier kind data learned and computed between HD signal and SD signal which the band made the large filter act and generated from the HD signal become a thing for acquiring HD signal with low resolution. It becomes possible to ask for the multiplier kind data for acquiring HD signal of the continuous resolution by carrying out sequential generation of two or more SD signals, and registering study data, as mentioned above.

[0168] in addition -- not illustrating, either -- timing doubling of SD pixel data x_i supplied to the normal-equation generation section 160 from this 1st tap selection circuitry 153 can be performed by arranging the delay circuit for time amount doubling in the preceding paragraph of the 1st tap selection circuitry 153.

[0169] Moreover, the data of the normal equation generated for every class in the normal-equation generation section 160 are supplied, and multiplier kind data generation equipment 150 solves a normal equation for every class, and has the multiplier kind data decision section 161 which asks for the multiplier kind data w_{10} - w_{n9} of each class, and the multiplier kind memory 162 which memorizes these called-for multiplier kind data w_{10} - w_{n9} . In the multiplier kind data decision section 161, a normal equation sweeps out, for example, it is solved by law etc., and the multiplier data w_{10} - w_{n9} are called for.

[0170] Actuation of the multiplier kind data generation equipment 150 shown in drawing 18 is explained. HD signal (525p signals or 1050i signals) as a teacher signal is supplied to an input terminal 151, and infanticide processing

horizontal in SD signal generation circuit 152 and vertical is performed to this HD signal, and SD signal (525i signals) as an input signal is generated.

[0171] In this case, when the 1st conversion approach (525p signals are acquired from 525i signals in the picture signal processing section 110 of drawing 1) is chosen, in SD signal generation circuit 152, interlaced processing is performed to 525p signals, and SD signal is generated. On the other hand, when the 2nd conversion approach (1050i signals are acquired from 525i signals in the picture signal processing section 110 of drawing 1) is chosen, in SD signal generation circuit 152, interlaced processing is performed to 1050i signals, and SD signal is generated. Moreover, Parameters h and v are supplied to SD signal generation circuit 152 as a control signal in this case, and sequential generation of two or more SD signals with which the horizontal and vertical band changed gradually is carried out.

[0172] The data (SD pixel data) of the space class tap located around the attention pixel concerning HD signal (525p signals or 1050i signals) by the 2nd tap selection circuitry 154 are alternatively taken out from this SD signal (525i signals). In this 2nd tap selection circuitry 154, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156, and the motion class detected in the motion class detector 158.

[0173] The data (SD pixel data) of a space class tap alternatively taken out by this 2nd tap selection circuitry 154 are supplied to the space class detector 157. In this space class detector 157, ADRC processing is performed to each SD pixel data as data of a space class tap, and the re-quantization code q_i as class information on a space class (mainly class classification for the wave expression in space) is obtained (refer to (1) type).

[0174] Moreover, the data (SD pixel data) of the motion class tap located around the attention pixel concerning HD signal by the 3rd tap selection circuitry 155 are alternatively taken out from SD signal generated in SD signal generation circuit 152. In this case, in the 3rd tap selection circuitry 155, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap

selection-control circuit 156.

[0175] The data (SD pixel data) of a motion class tap alternatively taken out by this 3rd tap selection circuitry 155 are supplied to the motion class detector 158. It moves by this motion class detector 158 from each SD pixel data as data of a motion class tap, and the class information MV on a class (class classification for mainly expressing extent of a motion) is acquired in it.

[0176] This motion information MV and the re-quantization code q_i mentioned above are supplied to the class composition circuit 159. In this class composition circuit 159, the class code CL which shows the class to which the attention pixel concerning HD signal (525p signals or 1050i signals) belongs is obtained from these motion information MV and the re-quantization code q_i (refer to (3) types).

[0177] Moreover, the data (SD pixel data) of the prediction tap located around the attention pixel concerning HD signal by the 1st tap selection circuitry 153 are alternatively taken out from SD signal generated in SD signal generation circuit 152. In this case, in the 1st tap selection circuitry 153, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156.

[0178] And each HD pixel data y as attention pixel data obtained from HD signal supplied to an input terminal 151 The data x_i of a prediction tap alternatively taken out by the 1st tap selection circuitry 153 respectively corresponding to each of this HD pixel data y (SD pixel data), From the class code CL outputted from the class composition circuit 159 respectively corresponding to each HD pixel data y , the normal equation (refer to (13) equations) for generating the multiplier kind data w_{10} - w_{n9} is generated for every class in the normal-equation generation section 160.

[0179] And the normal equation is solved in the multiplier kind data decision section 161, the multiplier kind data w_{10} - w_{n9} for every class are called for, and the multiplier kind data w_{10} - w_{n9} are memorized by the multiplier kind memory 162 by which address division was carried out according to the class.

[0180] Thus, in the multiplier kind data generation equipment 150 shown in drawing 18 , the multiplier kind data w_{10} - w_{n9} of each class memorized by the

information memory bank 135 of the picture signal processing section 110 of drawing 1 are generable. In this case, in SD signal generation circuit 152, SD signal (525i signals) is generated by the selected conversion approach using 525p signals or 1050i signals, and the multiplier kind data corresponding to the 1st conversion approach (525p signals are acquired from 525i signals in the picture signal processing section 110) and the 2nd conversion approach (1050i signals are acquired from 525i signals in the picture signal processing section 110) can be generated.

[0181] Next, other examples of the generation method of multiplier kind data are explained. Also in this example, the example which asks for the multiplier kind data w_{10} - w_{n9} which are multiplier data in the generation type of (5) types mentioned above shall be shown.

[0182] Drawing 20 shows the concept of this example. Two or more SD signals are generated from HD signal. For example, adjustable [of the parameters h and v which carry out adjustable / of the level band and perpendicular band of the filter used in case SD signal is generated from HD signal] is carried out to nine steps, respectively, and a total of 81 kinds of SD signals are generated. Thus, it learns between each SD signal and HD signals which were generated, and the presumed-type multiplier data W_i of (4) types are generated. And multiplier kind data are generated using the multiplier data W_i generated corresponding to each SD signal.

[0183] First, how to ask for presumed-type multiplier data is explained. Here, the example which asks for the presumed-type multiplier data W_i ($i=1-n$) of (4) types with the least square method shall be shown. The observation equation of (15) equations is considered as an accepted example, using Y as a forecast for X by using input data and W as multiplier data. In this (15) type, m shows the number of study data and n shows the number of prediction taps.

[0184]

[Equation 12]

$$XW = Y \quad \cdot \cdot \cdot (15)$$

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}, \quad W = \begin{bmatrix} W_1 \\ W_2 \\ \cdots \\ W_n \end{bmatrix}, \quad Y = \begin{bmatrix} y_1 \\ y_2 \\ \cdots \\ y_m \end{bmatrix}$$

[0185] (15) Apply the least square method to the data collected by the observation equation of an equation. The remainder equation of (16) equations is considered based on the observation equation of this (15) equation.

[0186]

[Equation 13]

$$XW = Y + E, \quad E = \begin{bmatrix} e_1 \\ e_2 \\ \cdots \\ e_m \end{bmatrix} \quad \cdot \cdot \cdot (16)$$

[0187] (16) every from the remainder equation of an equation -- the most probable value of W_i is considered to be the case where the conditions which make e_2 of (17) equations min are realized. Namely, what is necessary is just to take the conditions of (18) types into consideration.

[0188]

[Equation 14]

$$e^2 = \sum_{i=1}^m e_i^2 \quad \cdot \cdot \cdot (17)$$

$$e_1 \frac{\partial e_1}{\partial W_i} + e_2 \frac{\partial e_2}{\partial W_i} + \cdots + e_m \frac{\partial e_m}{\partial W_i} = 0 \quad (i=1, 2, \cdots, n) \quad \cdot \cdot \cdot (18)$$

[0189] That is, what is necessary is to consider n conditions based on i of (18) types, and just to compute W_1, W_2, \dots, W_n which fill this. Then, (19) equations are obtained from the remainder equation of (16) equations. Furthermore, (20) types are obtained from (19) types and (15) types.

[0190]

[Equation 15]

$$\frac{\partial e_i}{\partial W_1} = x_{i1}, \frac{\partial e_i}{\partial W_2} = x_{i2}, \dots, \frac{\partial e_i}{\partial W_n} = x_{in} (i=1, 2, \dots, m)$$

. . . (19)

$$\sum_{i=1}^m e_i x_{i1} = 0, \sum_{i=1}^m e_i x_{i2} = 0, \dots, \sum_{i=1}^m e_i x_{in} = 0$$

. . . (20)

[0191] And the normal equation of (16) equations and (20) equations to (21) equations is obtained.

[0192]

[Equation 16]

$$\begin{cases} \left(\sum_{j=1}^m x_{j1} x_{j1} \right) W_1 + \left(\sum_{j=1}^m x_{j1} x_{j2} \right) W_2 + \dots + \left(\sum_{j=1}^m x_{j1} x_{jn} \right) W_n = \left(\sum_{j=1}^m x_{j1} y_j \right) \\ \left(\sum_{j=1}^m x_{j2} x_{j1} \right) W_1 + \left(\sum_{j=1}^m x_{j2} x_{j2} \right) W_2 + \dots + \left(\sum_{j=1}^m x_{j2} x_{jn} \right) W_n = \left(\sum_{j=1}^m x_{j2} y_j \right) \\ \dots \\ \left(\sum_{j=1}^m x_{jn} x_{j1} \right) W_1 + \left(\sum_{j=1}^m x_{jn} x_{j2} \right) W_2 + \dots + \left(\sum_{j=1}^m x_{jn} x_{jn} \right) W_n = \left(\sum_{j=1}^m x_{jn} y_j \right) \end{cases}$$

. . . (21)

[0193] (21) since the normal equation of an equation can form the equation of the same number as several n of an unknown -- every -- the most probable value of W_i can be calculated. In this case, it will sweep out and simultaneous equations will be solved using law (method of elimination of Gauss-Jordan) etc.

[0194] Next, how to ask for multiplier kind data the multiplier data generated corresponding to each SD signal by using it is explained. The multiplier data of a certain class based on the study using SD signal corresponding to Parameters h and v presuppose that it was set to kvhi. Here, i is the number of a prediction tap. It asks for the multiplier kind data of this class from this kvhi.

[0195] Each multiplier data W_i ($i=1-n$) is expressed by (5) formulas mentioned above using the multiplier kind data $w_{10}-w_{n9}$. Here, considering using the least square method to the multiplier data W_i , the remainder is expressed with (22) types.

[0196]

[Equation 17]

$$e_{vhi} = k_{vhi} - (w_{i0} + w_{i1}v + w_{i2}h + w_{i3}v^2 + w_{i4}vh + w_{i5}h^2 + w_{i6}v^3 + w_{i7}v^2h + w_{i8}vh^2 + w_{i9}h^3) \\ = k_{vhi} - \sum_{j=0}^9 w_{ij} t_j \quad \dots (22)$$

[0197] Here, t_j is shown in above-mentioned (7) types. (22) (23) types will be obtained if the least square method is made to act on a formula.

[0198]

[Equation 18]

$$\frac{\partial}{\partial w_{ij}} = \sum_v \sum_h (e_{vhi})^2 = \sum_v \sum_h 2 \left(\frac{\partial e_{vhi}}{\partial w_{ij}} \right) e_{vhi} \\ = - \sum_v \sum_h 2 t_j e_{vhi} \\ = 0 \quad \dots (23)$$

[0199] Here, if X_{jk} and Y_j are defined like (24) types and (25) types, respectively, (23) types will be rewritten like (26) types. This (26) equation is also a normal equation and can compute the multiplier kind data w_{10} - w_{n9} by sweeping out this equation and solving by general solution methods, such as law.

[0200]

[Equation 19]

$$X_{jk} = \sum_v \sum_h t_j t_k \quad \dots (24)$$

$$Y_j = \sum_v \sum_h t_j k_{vhi} \quad \dots (25)$$

$$\begin{bmatrix} x_{00} & x_{01} & \dots & x_{09} \\ x_{10} & x_{11} & \dots & x_{19} \\ \vdots & \vdots & \ddots & \vdots \\ x_{90} & x_{91} & \dots & x_{99} \end{bmatrix} \begin{bmatrix} w_{i0} \\ w_{i1} \\ \vdots \\ w_{i9} \end{bmatrix} = \begin{bmatrix} y_0 \\ y_1 \\ \vdots \\ y_9 \end{bmatrix} \quad \dots (26)$$

[0201] Drawing 21 shows the configuration of multiplier kind data generation equipment 150' which generates multiplier kind data based on the concept shown in drawing 20. In this drawing 21, the same sign is given to drawing 20 and a corresponding part, and that detail explanation is omitted.

[0202] Each HD pixel data y as attention pixel data obtained from HD signal with which multiplier kind data generation equipment 150' is supplied to an input terminal 151. The data x_i of a prediction tap alternatively taken out by the 1st tap selection circuitry 153 respectively corresponding to each of this HD pixel data y (SD pixel data), It has the normal equation generation section 171 which generates the normal equation (refer to (21) equations) for obtaining the multiplier data W_i ($i=1-n$) for every class from the class code CL outputted from the class composition circuit 159 respectively corresponding to each HD pixel data y .

[0203] In this case, although study data are generated in the combination of HD pixel data y of a piece, and n prediction tap pixel data corresponding to it, sequential generation of two or more SD signals with which a sequential change of the parameters h and v to SD signal generation circuit 152 was made, and the horizontal and vertical band changed gradually is carried out, and generation of study data is performed between HD signal and each SD signal, respectively. Thereby, in the normal-equation generation section 171, each SD signal corresponds, respectively and the normal equation for obtaining the multiplier data W_i ($i=1-n$) is generated for every class.

[0204] Moreover, the data of the normal equation with which multiplier kind data generation equipment 150' was generated in the normal-equation generation section 171 are supplied. The multiplier data decision section 172 which solves the normal equation and asks for the multiplier data W_i of each class corresponding to each SD signal, respectively, The multiplier data W_i of each class corresponding to each of this SD signal are used, and it has the normal equation generation section 173 which generates the normal equation (refer to (26) equations) for obtaining the multiplier kind data $w_{10}-w_{n9}$ for every class.

[0205] Moreover, the data of the normal equation generated for every class in the normal-equation generation section 173 are supplied, and multiplier kind data generation equipment 150' solves a normal equation for every class, and has the multiplier kind data decision section 174 which asks for the multiplier kind data $w_{10}-w_{n9}$ of each class, and the multiplier kind memory 162 which memorizes these called-for multiplier kind data $w_{10}-w_{n9}$.

[0206] Others of multiplier kind data generation equipment 150' shown in drawing 21 are constituted like the multiplier kind data generation equipment 150 shown in drawing 18 .

[0207] The actuation of multiplier kind data generation equipment 150' shown in drawing 21 is explained. HD signal (525p signals or 1050i signals) as a teacher signal is supplied to an input terminal 151, and infanticide processing horizontal in SD signal generation circuit 152 and vertical is performed to this HD signal, and SD signal (525i signals) as an input signal is generated.

[0208] In this case, when the 1st conversion approach (525p signals are acquired from 525i signals in the picture signal processing section 110 of drawing 1) is chosen, in SD signal generation circuit 152, infanticide processing is performed to 525p signals, and SD signal is generated. On the other hand, when the 2nd conversion approach (1050i signals are acquired from 525i signals in the picture signal processing section 110 of drawing 1) is chosen, in SD signal generation circuit 152, infanticide processing is performed to 1050i signals, and SD signal is generated. Moreover, Parameters h and v are supplied to SD signal generation circuit 152 as a control signal in this case, and sequential generation of two or more SD signals with which the horizontal and vertical band changed gradually is carried out.

[0209] The data (SD pixel data) of the space class tap located around the attention pixel concerning HD signal (525p signals or 1050i signals) by the 2nd tap selection circuitry 154 are alternatively taken out from this SD signal (525i signals). In this 2nd tap selection circuitry 154, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156, and the motion class detected in the motion class detector 158.

[0210] The data (SD pixel data) of a space class tap alternatively taken out by this 2nd tap selection circuitry 154 are supplied to the space class detector 157. In this space class detector 157, ADRC processing is performed to each SD pixel data as data of a space class tap, and the re-quantization code q_i as class information on a space class (mainly class classification for the wave expression in space) is obtained (refer to (1) type).

[0211] Moreover, the data (SD pixel data) of the motion class tap located around the attention pixel concerning HD signal by the 3rd tap selection circuitry 155 are alternatively taken out from SD signal generated in SD signal generation circuit 152. In this case, in the 3rd tap selection circuitry 155, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156.

[0212] The data (SD pixel data) of a motion class tap alternatively taken out by this 3rd tap selection circuitry 155 are supplied to the motion class detector 158. It moves by this motion class detector 158 from each SD pixel data as data of a motion class tap, and the class information MV on a class (class classification for mainly expressing extent of a motion) is acquired in it.

[0213] This motion information MV and the re-quantization code q_i mentioned above are supplied to the class composition circuit 159. In this class composition circuit 159, the class code CL which shows the class to which the attention pixel concerning HD signal (525p signals or 1050i signals) belongs is obtained from these motion information MV and the re-quantization code q_i (refer to (3) types).

[0214] Moreover, the data (SD pixel data) of the prediction tap located around the attention pixel concerning HD signal by the 1st tap selection circuitry 153 are alternatively taken out from SD signal generated in SD signal generation circuit 152. In this case, in the 1st tap selection circuitry 153, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156.

[0215] And each HD pixel data y as attention pixel data obtained from HD signal supplied to an input terminal 151 The data x_i of a prediction tap alternatively taken out by the 1st tap selection circuitry 153 respectively corresponding to each of this HD pixel data y (SD pixel data), From the class code CL outputted from the class composition circuit 159 respectively corresponding to each HD pixel data y , in the normal equation generation section 171 Each SD signal generated in SD signal generation circuit 152 corresponds, respectively, and the normal equation (refer to (21) equations)

for obtaining the multiplier data W_i ($i=1-n$) is generated for every class.

[0216] And the normal equation is solved in the multiplier data decision section 172, and the multiplier data W_i of each class corresponding to each SD signal are called for, respectively. In the normal-equation generation section 173, the normal equation (refer to (26) equations) for obtaining the multiplier kind data $w_{10}-w_{n9}$ is generated for every class from the multiplier data W_i of each class corresponding to each of this SD signal, respectively.

[0217] And the normal equation is solved in the multiplier kind data decision section 174, the multiplier kind data $w_{10}-w_{n9}$ of each class are called for, and the multiplier kind data $w_{10}-w_{n9}$ are memorized by the multiplier kind memory 162 by which address division was carried out according to the class.

[0218] Thus, also in multiplier kind data generation equipment 150' shown in drawing 21, the multiplier kind data $w_{10}-w_{n9}$ of each class memorized by the information memory bank 135 of the picture signal processing section 110 of drawing 1 are generable. In this case, in SD signal generation circuit 152, SD signal ($525i$ signals) is generated by the selected conversion approach using $525p$ signals or $1050i$ signals, and the multiplier kind data corresponding to the 1st conversion approach ($525p$ signals are acquired from $525i$ signals in the picture signal processing section 110) and the 2nd conversion approach ($1050i$ signals are acquired from $525i$ signals in the picture signal processing section 110) can be generated.

[0219] In addition, although the generation type of (5) types was used in the picture signal processing section 110 of drawing 1 in order to generate the multiplier data W_i ($i=1-n$), (27) types, (28) types, etc. may be used and the polynomial from which the degree differed further, and the formula expressed with other functions can also be realized, for example.

[0220]

[Equation 20]

$$\begin{aligned}
W_1 &= w_{10} + w_{11}v + w_{12}h + w_{13}v^2 + w_{14}h^2 + w_{15}v^3 + w_{16}h^3 \\
W_2 &= w_{20} + w_{21}v + w_{22}h + w_{23}v^2 + w_{24}h^2 + w_{25}v^3 + w_{26}h^3 \\
&\vdots \\
W_i &= w_{i0} + w_{i1}v + w_{i2}h + w_{i3}v^2 + w_{i4}h^2 + w_{i5}v^3 + w_{i6}h^3 \\
&\vdots \\
W_n &= w_{n0} + w_{n1}v + w_{n2}h + w_{n3}v^2 + w_{n4}h^2 + w_{n5}v^3 + w_{n6}h^3 \\
&\quad \cdot \cdot \cdot (27)
\end{aligned}$$

$$\begin{aligned}
W_1 &= w_{10} + w_{11}v + w_{12}h + w_{13}v^2 + w_{14}v h + w_{15}h^2 \\
W_2 &= w_{20} + w_{21}v + w_{22}h + w_{23}v^2 + w_{24}v h + w_{25}h^2 \\
&\vdots \\
W_i &= w_{i0} + w_{i1}v + w_{i2}h + w_{i3}v^2 + w_{i4}v h + w_{i5}h^2 \\
&\vdots \\
W_n &= w_{n0} + w_{n1}v + w_{n2}h + w_{n3}v^2 + w_{n4}v h + w_{n5}h^2 \\
&\quad \cdot \cdot \cdot (28)
\end{aligned}$$

[0221] Moreover, although the picture signal processing section 110 of drawing 1 showed what can adjust the horizontal and vertical resolution of an image by setting up the parameter h which specifies horizontal resolution, and the parameter v which specifies vertical definition, and adjusting the value of the parameters h and v of these two or more classes For example, the parameter z which specifies whenever [noise rejection] (whenever [noise reduction]) can be formed, and what can adjust whenever [noise rejection / of an image] can consist of adjusting the value of this parameter z similarly.

[0222] In this case, as a generation type which generates the multiplier data W_i ($i=1-n$), for example, (29) types, (30) types, etc. can be used, and the polynomial from which the degree differed further, and the formula expressed with other functions can also be realized.

[0223]

[Equation 21]

$$\begin{aligned}
W_1 &= w_{10} + w_{11}z + w_{12}z^2 + w_{13}z^3 \\
W_2 &= w_{20} + w_{21}z + w_{22}z^2 + w_{23}z^3 \\
&\vdots \\
W_i &= w_{i0} + w_{i1}z + w_{i2}z^2 + w_{i3}z^3 \\
&\vdots \\
W_n &= w_{n0} + w_{n1}z + w_{n2}z^2 + w_{n3}z^3 \quad \dots (29)
\end{aligned}$$

$$\begin{aligned}
W_1 &= w_{10} + w_{11}z + w_{12}z^2 \\
W_2 &= w_{20} + w_{21}z + w_{22}z^2 \\
&\vdots \\
W_i &= w_{i0} + w_{i1}z + w_{i2}z^2 \\
&\vdots \\
W_n &= w_{n0} + w_{n1}z + w_{n2}z^2 \quad \dots (30)
\end{aligned}$$

[0224] In addition, the multiplier kind data which are generation-type multiplier data which contains Parameter z as mentioned above are generable with multiplier kind data generation equipment 150' shown in the multiplier kind data generation equipment 150 or drawing 21 shown in drawing 18 like the case where the multiplier kind data which are generation-type multiplier data containing the parameters h and v mentioned above are generated.

[0225] In that case, in case Parameter z is supplied as a control signal and generates SD signal from HD signal corresponding to the value of this parameter z, adjustable [of the noise addition condition over SD signal] is gradually carried out to SD signal generation circuit 152. Thus, by carrying out adjustable [of the noise addition condition over SD signal] gradually, and registering study data, the multiplier kind data for obtaining whenever [continuous noise rejection] are generable.

[0226] Here, some examples are shown about the detail of the noise addition approach corresponding to the value of Parameter z .

[0227] For example, as shown in drawing 22 A, the noise signal to which amplitude level was changed gradually is added to SD signal, and SD signal with which a noise level changes gradually is generated.

[0228] Moreover, although the noise signal of fixed amplitude level is added to SD signal for example, as shown in drawing 22 B, it carries out adjustable [of the screen area to add] gradually.

[0229] Further for example, as shown in drawing 22 C, that in which the noise is not contained, and the thing in which the noise is contained are prepared as an SD signal (one screen). And in case a normal equation is generated, multiple times are learned to each SD signal.

[0230] For example, in "a noise 0", 100 study is performed to SD signal without a noise, and in "Noise i", while performing 30 study to SD signal without a noise, 70 study is performed to SD signal with a noise. In this case, the direction of "Noise i" becomes the study system in which whenever [noise rejection] computes high multiplier kind data. Thus, the multiplier kind data for obtaining whenever [noise rejection / which followed having no noise by learning by changing gradually the count of study to SD signal with a noise] can be obtained.

[0231] this technique -- not mentioning above, either -- it is also realizable in the form of addition of a normal equation.

[0232] First, study which computes the presumed-type multiplier data in "noise 0" - "Noise i" is performed. The normal equation at this time comes to be shown in (21) equations mentioned above. Here, if P_{ij} and Q_j are defined like (31) types and (32) types, respectively, (21) types will be rewritten like (33) types. Here, in x_{ij} , the i -th study value of SD pixel data of the j -th prediction tap location and y_i express the i -th study value of HD pixel data, and W_i expresses the multiplier.

[0233]

[Equation 22]

$$P_{ij} = \sum_p x_{pi} x_{pj} \quad \dots (31)$$

$$Q_j = \sum_p x_{pj} y_p \quad \dots (32)$$

$$\begin{bmatrix} P_{11} & P_{12} & \dots & P_{1n} \\ P_{21} & P_{22} & \dots & P_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ P_{n1} & P_{n2} & \dots & P_{nn} \end{bmatrix} \begin{bmatrix} W_1 \\ W_2 \\ \vdots \\ W_n \end{bmatrix} = \begin{bmatrix} Q_1 \\ Q_2 \\ \vdots \\ Q_n \end{bmatrix} \quad \dots (33)$$

[0234] Define the left part of (33) types at the time of learning SD signal without a noise as [P1ij] using such study, define the right-hand side as [Q1i], the left part of (33) types at the time of learning SD signal with a noise is similarly defined as [P2ij], and the right-hand side is defined as [Q2i]. In such a case, [Paij] and [Qai] are defined like (34) types and (35) types. However, it is a (0≤a≤1).

[0235]

$$[Paij] = (1-a) [P1ij] + a [P2ij] \dots (34)$$

$$[Qai] = (1-a) [Q1i] + a [Q2i] \dots (35)$$

Here, the normal equation in a= 0 is expressed with (36) equations, this becomes the normal equation and equivalence of a case of the "noise 0" of drawing 22 C, and, in the case of a= 0.7, it becomes the normal equation and equivalence of a case of "Noise i."

$$[Paij] [Wi] = [Qai] \dots (36)$$

[0236] By changing this a gradually and making the normal equation of each noise level, the multiplier kind data made into the purpose can be obtained. In this case, Wi can be similarly computed for multiplier data from the normal equation of each noise level, respectively with multiplier kind data generation equipment 150' of drawing 21 having explained, and it can ask for multiplier kind data using the multiplier data of each of this phase.

[0237] Moreover, it is also possible by combining the normal equation of each noise level to generate the normal equation for obtaining multiplier kind data like (13) equations mentioned above. This technique is explained concretely below. Here, the case where the normal equation which asks for multiplier

kind data is generated using (30) equations mentioned above is considered. [0238] [P] and [Q] which are expressed to (34) types which generated how many kinds of SD signal of the noise level corresponding to that parameter z beforehand, learned beforehand, and were mentioned above, and (35) types are prepared. They are expressed as [Pnij] and [Qni]. Moreover, (7) types mentioned above are rewritten like (37) types again.

$$t_0=1, t_1=z, t_2=z^2 \dots (37)$$

[0239] In this case, (24) types and (25) types which were mentioned above are rewritten like (38) types and (39) types, respectively. It can ask for the multiplier kind data w_{ij} by solving (40) types from these formulas. Here, the variable showing the total of a prediction tap is rewritten to m.

[0240]

[Equation 23]

$$X_{ipjq} = \sum_z t_p t_q P_{zij} \dots (38)$$

$$Y_{ip} = \sum_z t_p Q_{zi} \dots (39)$$

$$\begin{bmatrix} X_{1010} & X_{1011} & X_{1012} & X_{1020} & \dots & X_{10m2} \\ X_{1110} & X_{1111} & X_{1112} & X_{1120} & \dots & X_{11m2} \\ X_{1210} & X_{1211} & X_{1212} & X_{1220} & \dots & X_{12m2} \\ X_{2010} & X_{2011} & X_{2012} & X_{2020} & \dots & X_{20m2} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ X_{m210} & X_{m211} & X_{m212} & X_{m220} & \dots & X_{m2m2} \end{bmatrix} \begin{bmatrix} w_{10} \\ w_{11} \\ w_{12} \\ w_{20} \\ \vdots \\ w_{m2} \end{bmatrix} = \begin{bmatrix} Y_{10} \\ Y_{11} \\ Y_{12} \\ Y_{20} \\ \vdots \\ Y_{m2} \end{bmatrix} \dots (40)$$

[0241] Moreover, the parameter h which specifies horizontal resolution, and the parameter v which specifies vertical definition are set up, and although what can adjust the horizontal and vertical resolution of an image by adjusting the value of the parameters h and v of these two or more classes was shown, it can also constitute from the picture signal processing section 110 of drawing 1 so that one parameter may adjust horizontal and vertical resolution. For example, one parameter r which specifies horizontal and vertical resolution is

set up. In this case, $h=2$, $v=2$, ..., or $r=1$ is considered [$r=1$] for $h=1$, $v=1$, and $r=2$ as correspondence relation [like $h=2$ $v=3$, and ...] whose $h=1$, $v=2$, and $r=2$ are. In this case, the polynomial of r etc. will be used as a generation type which generates the multiplier data W_i ($i=1-n$).

[0242] Moreover, although the picture signal processing section 110 of drawing 1 showed what can adjust the horizontal and vertical resolution of an image by setting up the parameter h which specifies horizontal resolution, and the parameter v which specifies vertical definition, and adjusting the value of the parameters h and v of these two or more classes By setting up the parameter r which specifies the horizontal and vertical resolution mentioned above, and the parameter z which specifies whenever [above-mentioned noise rejection] (whenever [noise reduction]), and adjusting the value of the parameters r and z of these two or more classes What can adjust the horizontal and vertical resolution of an image and whenever [noise rejection] can be constituted similarly.

[0243] In this case, as a generation type which generates the multiplier data W_i ($i=1-n$), for example, (41) types etc. can be used and the polynomial from which the degree differed further, and the formula expressed with other functions can also be realized.

[0244]

[Equation 24]

$$W_1 = w_{10} + w_{11}r + w_{12}z + w_{13}r^2 + w_{14}r z + w_{15}z^2 \\ + w_{16}r^3 + w_{17}r^2 z + w_{18}r z^2 + w_{19}z^3$$

$$W_2 = w_{20} + w_{21}r + w_{22}z + w_{23}r^2 + w_{24}r z + w_{25}z^2 \\ + w_{26}r^3 + w_{27}r^2 z + w_{28}r z^2 + w_{29}z^3$$

⋮

$$W_i = w_{i0} + w_{i1}r + w_{i2}z + w_{i3}r^2 + w_{i4}r z + w_{i5}z^2 \\ + w_{i6}r^3 + w_{i7}r^2 z + w_{i8}r z^2 + w_{i9}z^3$$

⋮

$$W_n = w_{n0} + w_{n1}r + w_{n2}z + w_{n3}r^2 + w_{n4}r z + w_{n5}z^2 \\ + w_{n6}r^3 + w_{n7}r^2 z + w_{n8}r z^2 + w_{n9}z^3$$

⋯ (4 1)

[0245] Thus, the user interface for adjusting two or more kinds of parameters r and z can also be constituted as shown in drawing 2 . By operating joy stick 200a, a user can move the location of icon 115a on the adjustment screen 115, and can adjust the value of the parameter z which specifies whenever [value / of the parameter r which specifies resolution /, and noise rejection] (whenever [noise reduction]) to arbitration. Drawing 24 expands and shows the part of the adjustment screen 115. The value of the parameter r which determines resolution by icon 115a being moved to right and left is adjusted, and the value of the parameter z which determines whenever [noise rejection] by on the other hand icon 115a being moved up and down is adjusted.

[0246] A user can adjust Parameters r and z with reference to the adjustment screen 115 displayed on the display section 111 (refer to drawing 2), and can perform the adjustment easily. In addition, the digital readout of the value of the parameters r and z adjusted by the user may be carried out on the adjustment screen 115.

[0247] Thus, the multiplier kind data which are generation-type multiplier data

containing Parameters r and z are generable with multiplier kind data generation equipment 150' shown in the multiplier kind data generation equipment 150 or drawing 21 shown in drawing 18 like the case where the multiplier kind data which are generation-type multiplier data containing the parameters h and v mentioned above are generated.

[0248] In that case, in case Parameters r and z are supplied as a control signal and generate SD signal from HD signal corresponding to the value of these parameters r and z , adjustable [of the horizontal and vertical band of SD signal and the noise addition condition over SD signal] is gradually carried out to SD signal generation circuit 152.

[0249] Drawing 23 shows the example of generation of SD signal corresponding to the value of Parameters r and z . In this example, adjustable [of the parameters r and z] is carried out to nine steps, respectively, and a total of 81 kinds of SD signals are generated. In addition, it may be made to carry out adjustable [of the parameters r and z] to much more phases rather than nine steps. In that case, although the precision of the multiplier kind data computed becomes good, computational complexity will increase.

[0250] Moreover, although the picture signal processing section 110 of drawing 1 showed what can adjust the horizontal and vertical resolution of an image by setting up the parameter h which specifies horizontal resolution, and the parameter v which specifies vertical definition, and adjusting the value of the parameters h and v of these two or more classes By setting up the parameter z which specifies whenever [noise rejection / which was further mentioned above] (whenever [noise reduction]) besides these parameters h and v , and adjusting the value of the parameters h , v , and z of these two or more classes What can adjust the horizontal and vertical resolution of an image and whenever [noise rejection] can be constituted similarly.

[0251] In this case, as a generation type which generates the multiplier data W_i ($i=1-n$), for example, (42) types etc. can be used and the polynomial from which the degree differed further, and the formula expressed with other functions can also be realized.

[0252]

[Equation 25]

$$\begin{aligned}
W_1 &= w_{1_0} \\
&+ w_{1_1}v + w_{1_2}h + w_{1_3}z \\
&+ w_{1_4}v^2 + w_{1_5}h^2 + w_{1_6}z^2 + w_{1_7}vh + w_{1_8}hz + w_{1_9}zv \\
&+ w_{1_{10}}v^3 + w_{1_{11}}h^3 + w_{1_{12}}z^3 + w_{1_{13}}v^2h + w_{1_{14}}vh^2 + w_{1_{15}}v h z \\
&+ w_{1_{16}}v z^2 + w_{1_{17}}h^2 z + w_{1_{18}}h z^2 + w_{1_{19}}z^3
\end{aligned}$$

$$\begin{aligned}
W_2 &= w_{2_0} \\
&+ w_{2_1}v + w_{2_2}h + w_{2_3}z \\
&+ w_{2_4}v^2 + w_{2_5}h^2 + w_{2_6}z^2 + w_{2_7}vh + w_{2_8}hz + w_{2_9}zv \\
&+ w_{2_{10}}v^3 + w_{2_{11}}h^3 + w_{2_{12}}z^3 + w_{2_{13}}v^2h + w_{2_{14}}vh^2 + w_{2_{15}}v h z \\
&+ w_{2_{16}}v z^2 + w_{2_{17}}h^2 z + w_{2_{18}}h z^2 + w_{2_{19}}z^3
\end{aligned}$$

⋮
⋮

$$\begin{aligned}
W_i &= w_{i_0} \\
&+ w_{i_1}v + w_{i_2}h + w_{i_3}z \\
&+ w_{i_4}v^2 + w_{i_5}h^2 + w_{i_6}z^2 + w_{i_7}vh + w_{i_8}hz + w_{i_9}zv \\
&+ w_{i_{10}}v^3 + w_{i_{11}}h^3 + w_{i_{12}}z^3 + w_{i_{13}}v^2h + w_{i_{14}}vh^2 + w_{i_{15}}v h z \\
&+ w_{i_{16}}v z^2 + w_{i_{17}}h^2 z + w_{i_{18}}h z^2 + w_{i_{19}}z^3
\end{aligned}$$

⋮
⋮

$$\begin{aligned}
W_n &= w_{n_0} \\
&+ w_{n_1}v + w_{n_2}h + w_{n_3}z \\
&+ w_{n_4}v^2 + w_{n_5}h^2 + w_{n_6}z^2 + w_{n_7}vh + w_{n_8}hz + w_{n_9}zv \\
&+ w_{n_{10}}v^3 + w_{n_{11}}h^3 + w_{n_{12}}z^3 + w_{n_{13}}v^2h + w_{n_{14}}vh^2 + w_{n_{15}}v h z \\
&+ w_{n_{16}}v z^2 + w_{n_{17}}h^2 z + w_{n_{18}}h z^2 + w_{n_{19}}z^3
\end{aligned}$$

. . . (4 2)

[0253] Thus, the user interface for adjusting Parameters h, v, and z can also be constituted as shown in drawing 2 . By operating joy stick 200a, a user can move the location of icon 115a on the adjustment screen 115, and can adjust the value of the parameter z which specifies whenever [value / of the parameters h and v which specify resolution /, and noise rejection] (whenever [noise reduction]) to arbitration.

[0254] Drawing 26 expands and shows the part of the adjustment screen 115. The value of the parameter h which determines level resolution by icon 115a being moved to right and left is adjusted, the value of the parameter v which determines perpendicular resolution by on the other hand icon 115a being moved up and down is adjusted, and the value of the parameter z which

determines whenever [noise rejection] by icon 115a being further moved in the depth direction is adjusted. What is necessary is just to operate joy stick 200a in the direction of slant, in order to move icon 115a in the depth direction.

[0255] In this case, it is possible to express the depth direction by changing the magnitude of icon 115a, the thickness of a color, or a tint. Icon 115a shown with the broken line in drawing is changing the magnitude, and shows the condition that icon 115a shown as a continuous line was moved in the depth direction.

[0256] A user can adjust Parameters h, v, and z with reference to the adjustment screen 115 displayed on the display section 111 (refer to drawing 2), and can perform the adjustment easily. In addition, the digital readout of the value of the parameters h, v, and z adjusted by the user may be carried out on the adjustment screen 115.

[0257] Thus, the multiplier kind data which are generation-type multiplier data containing Parameters h, v, and z are generable with multiplier kind data generation equipment 150' shown in the multiplier kind data generation equipment 150 or drawing 21 shown in drawing 18 like the case where the multiplier kind data which are generation-type multiplier data containing the parameters h and v mentioned above are generated.

[0258] In that case, in case Parameters h, v, and z are supplied as a control signal and generate SD signal from HD signal corresponding to the value of these parameters h, v, and z, adjustable [of the horizontal and vertical band of SD signal and the noise addition condition over SD signal] is gradually carried out to SD signal generation circuit 152.

[0259] Drawing 25 shows the example of generation of SD signal corresponding to the value of Parameters h, v, and z. In this example, adjustable [of the parameters h v, and z] is carried out to nine steps, respectively, and a total of 729 kinds of SD signals are generated. In addition, it may be made to carry out adjustable [of the parameters h, v, and z] to much more phases rather than nine steps. In that case, although the precision of the multiplier kind data computed becomes good, computational complexity will increase.

[0260] In addition, it is also possible to realize processing in the picture signal

processing section 110 of drawing 1 by software with the picture signal processor 300 as shown in drawing 27 .

[0261] First, the picture signal processor 300 shown in drawing 27 is explained. This picture signal processor 300 has CPU301 which controls actuation of the whole equipment, and RAM (random access memory)303 which constitutes the working area of ROM (read only memory)302 and CPU301 where a program of operation, multiplier kind data, etc. of this CPU301 were stored. These [CPU301, ROM302, and RAM303] are connected to the bus 304, respectively.

[0262] Moreover, the picture signal processor 300 has the hard disk drive (HDD) 305 as external storage, and the floppy (R) disk drive (FDD) 307 which drives the floppy (trademark) (R) disk 306. These drives 305,307 are connected to the bus 304, respectively.

[0263] Moreover, the picture signal processor 300 has the communications department 308 which connects with the communication networks 400, such as the Internet, by the cable or wireless. This communications department 308 is connected to the bus 304 through the interface 309.

[0264] Moreover, the picture signal processor 300 is equipped with the user interface section. This user interface section has the remote control signal receive circuit 310 which receives the remote control signal RM from the remote control transmitter 200, and the display 311 which consists of LCD (liquid crystal display) etc. A receiving circuit 310 is connected to a bus 304 through an interface 312, and the display 311 is similarly connected to the bus 304 through the interface 313.

[0265] Moreover, the picture signal processor 300 has the input terminal 314 for inputting SD signal, and the output terminal 315 for outputting HD signal. An input terminal 314 is connected to a bus 304 through an interface 316, and an output terminal 315 is similarly connected to a bus 304 through an interface 317.

[0266] Here, it can download through the communications department 308 from the communication networks 400, such as the Internet, instead of storing a processing program, multiplier kind data, etc. in ROM302 beforehand, as mentioned above, and can also be used, being able to accumulate in a hard

disk or RAM303. Moreover, you may make it offer these processing programs, multiplier kind data, etc. by the floppy (R) disk 306.

[0267] Moreover, instead of inputting SD signal which should be processed from an input terminal 314, it records on the hard disk beforehand, or you may download through the communications department 308 from the communication networks 400, such as the Internet. Moreover, instead of outputting HD signal after processing to an output terminal 315, a display 311 is supplied in parallel to it, and image display may be carried out, it may store in a hard disk further, or you may make it send out to the communication networks 400, such as the Internet, through the communications department 308.

[0268] Procedure is explained in order to acquire HD signal with reference to the flow chart of drawing 28 from SD signal in the picture signal processor 300 shown in drawing 27 .

[0269] First, processing is started at a step ST 1 and SD pixel data are inputted per a frame unit or field at a step ST 2. When this SD pixel data is inputted from an input terminal 314, this SD pixel data is temporarily stored in RAM303. Moreover, when this SD pixel data is recorded on the hard disk, by the hard disk drive 307, this SD pixel data is read and it stores in RAM303 temporarily. And it judges whether processing of all the frames of input SD pixel data or all the fields has finished with a step ST 3. When processing has finished, it is a step ST 4 and processing is ended. On the other hand, when processing has not finished, it progresses to a step ST 5.

[0270] At this step ST 5, the image quality assignment values (for example, value of Parameters h and v etc.) as which the user operated and inputted the remote control transmitter 200 are read from RAM303. And the image quality assignment value read at a step ST 6 and the multiplier kind data of each class are used, and a generation type (for example, (5) types) generates the presumed-type (refer to (4) types) multiplier data W_i of each class.

[0271] Next, corresponding to each HD pixel data which should be generated, the pixel data of a class tap and a prediction tap are acquired from SD pixel data inputted at a step ST 2 at a step ST 7. And it judges whether the processing which obtains HD pixel data in all the fields of SD pixel data

inputted at a step ST 8 was completed. When having ended, it moves to a step ST 2 at SD pixel entry-of-data processing of return, the following frame, or the field. On the other hand, when processing is not completed, it progresses to a step ST 9.

[0272] At this step ST 9, the class code CL is generated from SD pixel data of the class tap acquired at a step ST 7. And the multiplier data and SD pixel data of a prediction tap corresponding to the class code CL are used at a step ST 10, by the presumed type, HD pixel data are generated and the processing same with having returned to a step ST 7 and having mentioned above after that is repeated.

[0273] Thus, SD pixel data which constitute inputted SD signal from processing along with the flow chart shown in drawing 28 can be processed, and HD pixel data which constitute HD signal can be obtained. As mentioned above, are outputted to an output terminal 315, or a display 311 is supplied, the image by it is displayed, or HD signal which processed in this way and was acquired is further supplied to a hard disk drive 305, and is recorded on a hard disk.

[0274] Moreover, although illustration of a processor is omitted, it is also possible to realize processing in the multiplier kind data generation equipment 150 of drawing 18 by software.

[0275] With reference to the flow chart of drawing 29, the procedure for generating multiplier kind data is explained. First, processing is started at a step ST 21 and the image quality pattern (for example, specified with Parameters h and v) used for study at a step ST 22 is chosen. And it judges whether study finished with a step ST 23 to all image quality patterns. When study has finished to no image quality selection patterns, it progresses to a step ST 24.

[0276] At this step ST 24, known HD pixel data are inputted per a frame unit or field. And it judges whether processing was completed about all HD pixel data at a step ST 25. When it ends, it returns to a step ST 22 and the same processing is repeated with having chosen and mentioned the following image quality pattern above. On the other hand, when having not ended, it progresses to a step ST 26.

[0277] At this step ST 26, SD pixel data are generated from HD pixel data inputted at a step ST 24 based on the image quality pattern chosen at a step ST 22. And corresponding to each HD pixel data inputted at a step ST 24, the pixel data of a class tap and a prediction tap are acquired from SD pixel data generated at a step ST 26 at a step ST 27. And it judges whether study processing is ended in all the fields of SD pixel data generated at a step ST 28. When having ended study processing, it returns to a step ST 24, the processing same with having mentioned above by performing the following HD pixel entry of data is repeated, and on the other hand, when having not ended study processing, it progresses to a step ST 29.

[0278] At this step ST 29, the class code CL is generated from SD pixel data of the class tap acquired at a step ST 27. And a normal equation (refer to (13) equations) is generated at a step ST 30. After that, it returns to a step ST 27.

[0279] Moreover, when study finishes with a step ST 23 to all image quality patterns, it progresses to a step ST 31. In this step ST 31, by sweeping out a normal equation and solving by law etc., the multiplier kind data of each class are computed, that multiplier kind data is saved in memory at a step ST 32, and processing is ended at a step ST 33 after that.

[0280] Thus, the multiplier kind data of each class can be obtained by processing along with the flow chart shown in drawing 29 by the same technique as the multiplier kind data generation equipment 150 shown in drawing 18 . Moreover, although illustration of a processor is omitted, the processing in multiplier kind data generation equipment 150' of drawing 21 is also realizable with software.

[0281] With reference to the flow chart of drawing 30 , the procedure for generating multiplier kind data is explained. First, processing is started at a step ST 41 and the image quality pattern (for example, specified with Parameters h and v) used for study at a step ST 42 is chosen. And it judges whether the calculation processing of multiplier data to all image quality patterns was completed at a step ST 43. When having not ended, it progresses to a step ST 44.

[0282] At this step ST 44, known HD pixel data are inputted per a frame unit or field. And it judges whether processing was completed about all HD pixel

data at a step ST 45. When having not ended, it is a step ST 46 and SD pixel data are generated from HD pixel data inputted at a step ST 44 based on the image quality pattern chosen at a step ST 42.

[0283] And corresponding to each HD pixel data inputted at a step ST 44, the pixel data of a class tap and a prediction tap are acquired from SD pixel data generated at a step ST 46 at a step ST 47. And it judges whether study processing is ended in all the fields of SD pixel data generated at a step ST 48. When having ended study processing, it returns to a step ST 44, the processing same with having mentioned above by performing the following HD pixel entry of data is repeated, and on the other hand, when having not ended study processing, it progresses to a step ST 49.

[0284] At this step ST 49, the class code CL is generated from SD pixel data of the class tap acquired at a step ST 47. And the normal equation (refer to (21) equations) for obtaining multiplier data at a step ST 50 is generated. After that, it returns to a step ST 47.

[0285] When processing is completed about all HD pixel data at the step ST 45 mentioned above, it is a step ST 51, and the multiplier data of each class are computed by sweeping out the normal equation generated at a step ST 50, and solving by law etc. After that, it returns to a step ST 42, the same processing is repeated with having chosen and mentioned the following image quality pattern above, and it asks for the multiplier data of each class corresponding to the following image quality pattern.

[0286] Moreover, when the calculation processing of multiplier data to all image quality patterns is completed at the above-mentioned step ST 43, it progresses to a step ST 52. At this step ST 52, the normal equation (refer to (26) equations) for asking for multiplier kind data is generated from the multiplier data to all image quality patterns.

[0287] And by sweeping out the normal equation generated at a step ST 52 by the step ST 53, and solving by law etc., the multiplier kind data of each class are computed, the multiplier kind data is saved in memory at a step ST 54, and processing is ended at a step ST 55 after that.

[0288] Thus, the multiplier kind data of each class can be obtained by processing along with the flow chart shown in drawing 30 by the same

technique as multiplier kind data generation equipment 150' shown in drawing 21 .

[0289] Next, the gestalt of other operations of this invention is explained.

Drawing 31 shows the configuration of television receiver 100' as a gestalt of other operations. This television receiver 100' also acquires 525i signals as an SD signal from a broadcast signal, and changes this 525i signal into 525p signals or 1050i signals as an HD signal, and the image by that 525p signal or 1050i signals is displayed. In this drawing 31 , the same sign is attached and shown in drawing 1 and a corresponding part.

[0290] The picture signal processing section 110 of the television receiver 100 shown in drawing 1 is transposed to picture signal processing section 110', and television receiver 100' carries out the same actuation as the television receiver 100.

[0291] The detail of picture signal processing section 110' is explained. In this picture signal processing section 110', the same sign is given to the picture signal processing section 110 shown in drawing 1 , and a corresponding part, and that detail explanation is omitted.

[0292] This picture signal processing section 110' has information memory bank 135'. The assignment information of operation for storing in a register 130 and the tap positional information for storing in registers 131-133 are beforehand stored in this information memory bank 135' like the information memory bank 135 in the picture signal processing section 110 shown in drawing 1 . Furthermore, the multiplier data for every combination of the value of the class and Parameters h and v corresponding to each of the 1st conversion approach (525p) and the 2nd conversion approach (1050i) are beforehand stored in this information memory bank 135'. About the generation method of this multiplier data, it mentions later.

[0293] Actuation of this picture signal processing section 110' is explained. The data (SD pixel data) of a space class tap are alternatively taken out from SD signal (525i signals) memorized by buffer memory 109 by the 2nd tap selection circuitry 122. In this case, in the 2nd tap selection circuitry 122, selection of a tap is performed based on the tap positional information corresponding to the conversion approach which is supplied from a register

132 and which was chosen by the user, and the motion class detected in the motion class detector 125.

[0294] The data (SD pixel data) of a space class tap alternatively taken out by this 2nd tap selection circuitry 122 are supplied to the space class detector 124. In this space class detector 124, ADRC processing is performed to each SD pixel data as data of a space class tap, and the re-quantization code q_i as class information on a space class (mainly class classification for the wave expression in space) is obtained (refer to (1) type).

[0295] Moreover, the data (SD pixel data) of a motion class tap are alternatively taken out from SD signal (525i signals) memorized by buffer memory 109 by the 3rd tap selection circuitry 123. In this case, in the 3rd tap selection circuitry 123, selection of a tap is performed based on the tap positional information corresponding to the conversion approach which is supplied from a register 133 and which was chosen by the user.

[0296] The data (SD pixel data) of a motion class tap alternatively taken out by this 3rd tap selection circuitry 123 are supplied to the motion class detector 125. It moves by this motion class detector 125 from each SD pixel data as data of a motion class tap, and the class information MV on a class (class classification for mainly expressing extent of a motion) is acquired in it.

[0297] This motion information MV and the re-quantization code q_i mentioned above are supplied to the class composition circuit 126. In this class composition circuit 126, the class code CL which shows the class to which the pixel (attention pixel) of HD signal (525p signals or 1050i signals) which should be created belongs is obtained from these motion information MV and the re-quantization code q_i (refer to (3) types). And this class code CL is read to a coefficient memory 134, and is supplied as address information.

[0298] The multiplier data of each class corresponding to the value and the conversion approach of Parameters h and v which were adjusted by the user are loaded and stored in a coefficient memory 134 from information memory bank 135' at a perpendicular blanking period. By the class code CL reading and being supplied as address information, as mentioned above, the multiplier data W_i corresponding to the class code CL are read from this coefficient memory 134, and the presumed prediction arithmetic circuit 127 is supplied.

[0299] In addition, when the multiplier data corresponding to the value of the parameters h and v adjusted to information memory bank 135' are not stored, the multiplier data corresponding to the value before and behind the value of the adjusted parameters h and v are read from information memory bank 135', and you may make it obtain the multiplier data corresponding to the value of the adjusted parameters h and v by interpolation data processing using them.

[0300] Moreover, the data (SD pixel data) of a prediction tap are alternatively taken out from SD signal (525i signals) memorized by buffer memory 109 by the 1st tap selection circuitry 121. In this case, in the 1st tap selection circuitry 121, selection of a tap is performed based on the tap positional information corresponding to the conversion approach which is supplied from a register 131 and which was chosen by the user. The data (SD pixel data) x_i of a prediction tap alternatively taken out by this 1st tap selection circuitry 121 are supplied to the presumed prediction arithmetic circuit 127.

[0301] In the presumed prediction arithmetic circuit 127, the data (HD pixel data) y of the pixel (attention pixel) of HD signal which should be created calculate from the data (SD pixel data) x_i of a prediction tap, and the multiplier data W_i read from a coefficient memory 134 (refer to (4) types). In this case, the 4-pixel data which constitute HD signal are generated instantaneous.

[0302] When the 1st conversion approach which outputs 525p signals is chosen by this, it is the odd number (o) field and the even number (e) field, and the Rhine data L1 of the same location as Rhine of 525i signals and the Rhine data L2 of the mid-position of Rhine of the upper and lower sides of 525i signals are generated (refer to drawing 4). Moreover, when the 2nd conversion approach which outputs 1050i signals is chosen, it is the odd number (o) field and the even number (e) field, and the Rhine data L1 of a location near Rhine of 525i signals, $L1'$, and the Rhine data L2 of a location far from Rhine of 525i signals and $L2'$ are generated (refer to drawing 5).

[0303] Thus, the Rhine data L1 and L2 ($L1'$, $L2'$) generated in the presumed prediction arithmetic circuit 127 are supplied to the line sequential conversion circuit 129. And in this line sequential conversion circuit 129, the Rhine data L1 and L2 ($L1'$, $L2'$) are made line sequential, and HD signal is generated. In this case, the line sequential conversion circuit 129 carries out actuation

according to the movement directive information corresponding to the conversion approach which is supplied from a register 130 and which was chosen by the user. Therefore, when the 1st conversion approach (525p) is chosen by the user, 525p signals are outputted from the line sequential conversion circuit 129. On the other hand, when the 2nd conversion approach (1050i) is chosen by the user, 1050i signals are outputted from the line sequential conversion circuit 129.

[0304] Thus, in picture signal processing section 110', the presumed-type multiplier data W_i ($i=1-n$) corresponding to the value of the adjusted parameters h and v are used, and HD pixel data y calculate. Therefore, a user is adjusting the value of Parameters h and v , and can adjust the image quality of the image by HD signal freely with the shaft of horizontal resolution and vertical definition.

[0305] As mentioned above, the multiplier data for every combination of the value of the class and Parameters h and v corresponding to each of the 1st and 2nd conversion approach are beforehand stored in information memory bank 135'. This multiplier data is beforehand generated by study.

[0306] By ****, the study using it generated the multiplier data of each class for every SD signal obtained as other examples of the generation method of multiplier kind data by carrying out adjustable [of the value of Parameters h and v] gradually first, and what asks for the multiplier kind data of each class next using the multiplier data of each class for every SD signal was explained. The multiplier data for every combination of the value of the class and Parameters h and v which are beforehand stored in information memory bank 135' are generable by the same approach as a part for the first portion in the generation method of this multiplier kind data.

[0307] Drawing 32 shows multiplier data generation equipment 180. In this multiplier data generation equipment 180, the same sign is given to multiplier kind data generation equipment 150' shown in drawing 21 , and a corresponding part, and that detail explanation is omitted.

[0308] With this multiplier data generation equipment 180, it has the coefficient memory 162. The multiplier data W_i of each class corresponding to each SD signal determined as this coefficient memory 162 in the multiplier

data decision section 172 are memorized. Others of this multiplier data generation equipment 180 are constituted like multiplier kind data generation equipment 150' shown in drawing 21 .

[0309] Actuation of the multiplier data generation equipment 180 shown in drawing 32 is explained. HD signal (525p signals or 1050i signals) as a teacher signal is supplied to an input terminal 151, and infanticide processing horizontal in SD signal generation circuit 152 and vertical is performed to this HD signal, and SD signal (525i signals) as an input signal is generated.

[0310] In this case, when the 1st conversion approach (525p signals are acquired from 525i signals by picture signal processing section 110' of drawing 31) is chosen, in SD signal generation circuit 152, infanticide processing is performed to 525p signals, and SD signal is generated. On the other hand, when the 2nd conversion approach (1050i signals are acquired from 525i signals by picture signal processing section 110' of drawing 31) is chosen, in SD signal generation circuit 152, infanticide processing is performed to 1050i signals, and SD signal is generated. Moreover, Parameters h and v are supplied to SD signal generation circuit 152 as a control signal in this case, and sequential generation of two or more SD signals with which the horizontal and vertical band changed gradually is carried out.

[0311] The data (SD pixel data) of the space class tap located around the attention pixel concerning HD signal (525p signals or 1050i signals) by the 2nd tap selection circuitry 154 are alternatively taken out from this SD signal (525i signals). In this 2nd tap selection circuitry 154, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156, and the motion class detected in the motion class detector 158.

[0312] The data (SD pixel data) of a space class tap alternatively taken out by this 2nd tap selection circuitry 154 are supplied to the space class detector 157. In this space class detector 157, ADRC processing is performed to each SD pixel data as data of a space class tap, and the re-quantization code q_i as class information on a space class is obtained (refer to (1) type).

[0313] Moreover, the data (SD pixel data) of the motion class tap located

around the attention pixel concerning HD signal by the 3rd tap selection circuitry 155 are alternatively taken out from SD signal generated in SD signal generation circuit 152. In this case, in the 3rd tap selection circuitry 155, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156.

[0314] The data (SD pixel data) of a motion class tap alternatively taken out by this 3rd tap selection circuitry 155 are supplied to the motion class detector 158. It moves by this motion class detector 158 from each SD pixel data as data of a motion class tap, and the class information MV on a class is acquired in it.

[0315] This motion information MV and the re-quantization code q_i mentioned above are supplied to the class composition circuit 159. In this class composition circuit 159, the class code CL which shows the class to which the attention pixel concerning HD signal (525p signals or 1050i signals) belongs is obtained from these motion information MV and the re-quantization code q_i (refer to (3) types).

[0316] Moreover, the data (SD pixel data) of the prediction tap located around the attention pixel concerning HD signal by the 1st tap selection circuitry 153 are alternatively taken out from SD signal generated in SD signal generation circuit 152. In this case, in the 1st tap selection circuitry 153, selection of a tap is performed based on the tap positional information corresponding to the selected conversion approach supplied from the tap selection-control circuit 156.

[0317] And each HD pixel data y as attention pixel data obtained from HD signal supplied to an input terminal 151 The data x_i of a prediction tap alternatively taken out by the 1st tap selection circuitry 153 respectively corresponding to each of this HD pixel data y (SD pixel data), From the class code CL outputted from the class composition circuit 159 respectively corresponding to each HD pixel data y , in the normal equation generation section 171 Each SD signal generated in SD signal generation circuit 152 corresponds, respectively, and the normal equation (refer to (21) equations) for obtaining the multiplier data W_i ($i=1-n$) is generated for every class.

[0318] And the normal equation is solved in the multiplier data decision section 172, and the multiplier data W_i of each class corresponding to each SD signal are called for, respectively. That is, a class and the multiplier data W_i for every combination of the value of Parameters h and v are obtained from the multiplier data decision section 172. This multiplier data W_i is memorized by the coefficient memory 162 by which address division was carried out according to a class and the combination of the value of Parameters h and v .

[0319] Thus, in the multiplier data generation equipment 180 shown in drawing 32, the multiplier data W_i for every combination of the value of the class and Parameters h and v which are memorized by information memory bank 135 of picture signal processing section 110' of drawing 31 are generable. In this case, in SD signal generation circuit 152, SD signal (525i signals) is generated by the selected conversion approach using 525p signals or 1050i signals, and the multiplier data corresponding to the 1st conversion approach and the 2nd conversion approach can be generated.

[0320] In addition, although picture signal processing section 110' of drawing 31 showed what can adjust the horizontal and vertical resolution of an image by setting up the parameter h which specifies horizontal resolution, and the parameter v which specifies vertical definition, and adjusting the value of these parameters h and v . The parameter r which specifies horizontal and vertical resolution similarly that the part of the television receiver 100 of drawing 1 explained The parameter z which specifies whenever [noise rejection] (whenever [noise reduction]) is set up, and what can adjust the horizontal and vertical resolution of an image and whenever [noise rejection] can consist of adjusting the value of these parameters r and z similarly. In this case, the multiplier data for every combination of the value of the class and Parameters r and z corresponding to each conversion approach will be beforehand stored in information memory bank 135 of picture signal processing section 110', respectively.

[0321] This multiplier data is generable with the multiplier data generation equipment 180 shown in drawing 32 like the case where the multiplier data corresponding to the value of the parameters h and v mentioned above are

generated. In that case, in case Parameters r and z are supplied as a control signal and generate SD signal from HD signal corresponding to the value of these parameters r and z, adjustable [of the horizontal and vertical band of SD signal and the noise addition condition over SD signal] is gradually carried out to SD signal generation circuit 152.

[0322] Moreover, although picture signal processing section 110' of drawing 31 showed what can adjust the horizontal and vertical resolution of an image by setting up the parameter h which specifies horizontal resolution, and the parameter v which specifies vertical definition, and adjusting the value of these parameters h and v The parameters h and v which specify horizontal and vertical resolution similarly that the part of the television receiver 100 of drawing 1 explained, respectively, The parameter z which specifies whenever [noise rejection] (whenever [noise reduction]) is set up, and what can adjust whenever [horizontal and vertical resolution / of an image / and noise rejection] can consist of similarly adjusting the value of these parameters h, v, and z. In this case, the multiplier data for every combination of the value of the class and Parameters h, v, and z corresponding to each conversion approach will be beforehand stored in information memory bank 135 of picture signal processing section 110' , respectively.

[0323] This multiplier data as well as the case where the multiplier data corresponding to the value of the parameters h and v mentioned above are generated is generable with the multiplier data generation equipment 180 shown in drawing 32 . In that case, in case Parameters h, v, and z are supplied as a control signal and generate SD signal from HD signal corresponding to the value of these parameters h, v, and z, adjustable [of the noise addition condition over the horizontal and vertical band of SD signal and SD signal] is gradually carried out to SD signal generation circuit 152.

[0324] In addition, it is also possible to realize processing in picture signal processing section 110' of drawing 31 by software with the picture signal processor 300 shown in drawing 27 like the processing in the picture signal processing section 110 of drawing 1 . In this case, multiplier data are used for ROM302 grade, storing them in it beforehand.

[0325] With reference to the flow chart of drawing 33 , the procedure for

acquiring HD signal from SD signal in the picture signal processor shown in drawing 27 is explained. First, processing is started at a step ST 61 and SD pixel data are inputted per a frame unit or field at step S62. When this SD pixel data is inputted from an input terminal 314, this SD pixel data is temporarily stored in RAM303. Moreover, when this SD pixel data is recorded on the hard disk, by the hard disk drive 307, this SD pixel data is read and it stores in RAM303 temporarily. And it judges whether processing of all the frames of input SD pixel data or all the fields has finished with a step ST 63. When processing has finished, it is a step ST 64 and processing is ended. On the other hand, when processing has not finished, it progresses to a step ST 65.

[0326] At this step ST 65, the image quality assignment values (for example, value of Parameters h and v etc.) as which the user operated and inputted the remote control transmitter 200 are read from RAM303. And based on the image quality assignment value read at a step ST 66, the multiplier data W_i of each class corresponding to the image quality assignment value are read from ROM302 grade, and it stores in RAM303 temporarily.

[0327] Next, corresponding to each HD pixel data which should be generated, the pixel data of a class tap and a prediction tap are acquired from SD pixel data inputted at a step ST 62 at a step ST 67. And it judges whether the processing which obtains HD pixel data in all the fields of SD pixel data inputted at a step ST 68 was completed. When having ended, it moves to a step ST 62 at SD pixel entry-of-data processing of return, the following frame, or the field. On the other hand, when processing is not completed, it progresses to a step ST 69.

[0328] At this step ST 69, the class code CL is generated from SD pixel data of the class tap acquired at a step ST 67. And the multiplier data and SD pixel data of a prediction tap corresponding to the class code CL are used at a step ST 70, by the presumed type, HD pixel data are generated and the processing same with having returned to a step ST 67 and having mentioned above after that is repeated.

[0329] Thus, SD pixel data which constitute inputted SD signal from processing along with the flow chart shown in drawing 33 can be processed,

and HD pixel data which constitute HD signal can be obtained. As mentioned above, are outputted to an output terminal 315, or a display 311 is supplied, the image by it is displayed, or HD signal which processed in this way and was acquired is further supplied to a hard disk drive 305, and is recorded on a hard disk. Moreover, although illustration of a processor is omitted, the processing in the multiplier data generation equipment 180 of drawing 32 is also realizable with software.

[0330] The procedure for generating multiplier data is explained with reference to the flow chart of drawing 34 . First, processing is started at a step ST 81 and the image quality pattern (for example, specified with Parameters h and v) used for study at a step ST 82 is chosen. And it judges whether the calculation processing of multiplier data to all image quality patterns was completed at a step ST 83. When having not ended, it progresses to a step ST 84.

[0331] At this step ST 84, known HD pixel data are inputted per a frame unit or field. And it judges whether processing was completed about all HD pixel data at a step ST 85. When having not ended, it is a step ST 86 and SD pixel data are generated from HD pixel data inputted at a step ST 84 based on the image quality pattern chosen at a step ST 82.

[0332] And corresponding to each HD pixel data inputted at a step ST 84, the pixel data of a class tap and a prediction tap are acquired from SD pixel data generated at a step ST 86 at a step ST 87. And it judges whether study processing is ended in all the fields of SD pixel data generated at a step ST 88. When having ended study processing, it returns to a step ST 84, the processing same with having mentioned above by performing the following HD pixel entry of data is repeated, and on the other hand, when having not ended study processing, it progresses to a step ST 89.

[0333] At this step ST 89, the class code CL is generated from SD pixel data of the class tap acquired at a step ST 87. And the normal equation (refer to (21) equations) for obtaining multiplier data at a step ST 90 is generated. After that, it returns to a step ST 87.

[0334] When processing is completed about all HD pixel data at the step ST 85 mentioned above, it is a step ST 91, and the multiplier data of each class

are computed by sweeping out the normal equation generated at a step ST 90, and solving by law etc. After that, it returns to a step ST 82, the same processing is repeated with having chosen and mentioned the following image quality pattern above, and it asks for the multiplier data of each class corresponding to the following image quality pattern.

[0335] Moreover, when the calculation processing of multiplier data to all image quality patterns is completed at the above-mentioned step ST 83, it is a step ST 92, and the multiplier data of each class to all image quality patterns are saved in memory, it is a step ST 93 after that, and processing is ended.

[0336] Thus, the multiplier data of each class to all image quality patterns can be obtained by processing along with the flow chart shown in drawing 34 by the same technique as the multiplier data generation equipment 180 shown in drawing 32.

[0337] In addition, in the gestalt of the above-mentioned implementation, although what used the linearity linear equation as a presumed equation at the time of generating HD signal was mentioned, it is not limited to this and an equation of higher degree may be used as a presumed equation.

[0338] Moreover, in the gestalt of the above-mentioned implementation, although the example which changes SD signal (525i signals) into HD signal (525p signals or 1050i signals) was shown, as for this invention, it is needless to say that it is applicable similarly [in the case of others which are not limited to it and change the 1st picture signal into the 2nd picture signal using a presumed type].

[0339] In addition, in the gestalt of the above-mentioned implementation, although the function of a resolution rise or noise oppression (noise rejection) can be continuously switched by changing the value of the parameter inputted, what can be further switched also to functions, such as a decryption and conversion of a signal format, besides these resolution rise or noise oppression can be constituted similarly.

[0340] Drawing 35 shows the picture signal processor 500 which can switch functions, such as a resolution rise, noise oppression, decoding of an MPEG signal, decoding of a JPEG (Joint Photographic Experts Group) signal, and conversion to a component signal from a composite signal.

[0341] This picture signal processor 500 consists of an input terminal 501 into which the input video signal V_{in} is inputted, the picture signal processing section 502 which processes to the input video signal V_{in} inputted into this input terminal 501, and obtains output video signal V_{out} , and an output terminal 503 which outputs output video signal V_{out} obtained in this picture signal processing section 502.

[0342] Parameter P is inputted into the picture signal processing section 502. This parameter P is for choosing the function of the picture signal processing section 502. For example, as shown in drawing 36, when it is $P=P1$, the function of a resolution rise is chosen. When it is $P=P2$, the function of noise oppression is chosen, and when it is $P=P3$, the function of an MPEG signal (rate a) of decoding is chosen. When it is $P=P4$, the function of an MPEG signal (rate b) of decoding is chosen, when it is $P=P5$, the function of the conversion to a component signal from a composite signal is chosen, and when it is $P=P6$, the function of a JPEG signal of decoding is chosen. Processing of the selected function is performed in the picture signal processing section 502.

[0343] Moreover, class detecting-element 502a which detects Class CL like the picture signal processing section 110 of drawing 1 from the data of the class tap extracted from the input picture signal V_{in} as for the picture signal processing section 502, Multiplier data generating section 502b which generates the presumed-type multiplier data W_i corresponding to them from Class CL and Parameter P which are detected by this class detecting-element 502a, It has data generation section 502c which generates the data which constitute the output picture signal V_{out} from multiplier data generated in this multiplier data generating section 502b, and data of the prediction tap extracted from the input video signal V_{in} . It has the memory in which the multiplier data W_i of each class corresponding to the value, $P1-P6$, of Parameter P were stored, respectively, and multiplier data generating section 502b reads and outputs the multiplier data W_i corresponding to the value of the class CL detected by class detecting-element 502a from this memory, and the inputted parameter P . [i.e.,]

[0344] In addition, the generation type for generating the presumed-type

multiplier data W_i as shown in (43) types is set up, the multiplier kind data w_0 - w_n which are the generation-type multiplier data concerned are stored in memory for every class, and you may enable it to calculate the multiplier data W_i corresponding to the value of the class CL detected by this generation type by class detecting-element 502a, and the inputted parameter P.

$$W_i = w_0 + w_1P + w_2P^2 + \dots + w_nP^n \dots (43)$$

[0345] Actuation of the picture signal processor 500 shown in drawing 35 is explained. The input picture signal V_{in} supplied to an input terminal 501 is supplied to the picture signal processing section 502. The input picture signal V_{in} supplied to this picture signal processing section 502 is supplied to class detecting-element 502a. In this class detecting-element 502a, detection of Class CL is performed based on the data of the class tap extracted from the input picture signal V_{in} . Thus, the class CL detected by the class detecting element 502 is supplied to multiplier data generating section 502b.

[0346] The parameter P inputted into the picture signal processing section 502 is supplied to this multiplier data generating section 502. And in multiplier data generating section 502b, it corresponds to Class CL and the presumed-type multiplier data W_i corresponding to the value of Parameter P are generated. These presumed-type multiplier data W_i are supplied to data generation section 502c.

[0347] Moreover, the input picture signal V_{in} is supplied to data generation section 502c. In this data generation section 502c, while the data of a prediction tap are extracted from the input picture signal V_{in} , the multiplier data W_i are used and the data which constitute the output picture signal V_{out} by the presumed type are generated. And the data generated by this data generation section 502c are outputted as an output picture signal V_{out} from the picture signal processing section 502, and this output picture signal V_{out} is outputted to an output terminal 503.

[0348] As mentioned above, in multiplier data generating section 502b of the picture signal processing section 502, the multiplier data W_i corresponding to the value of the inputted parameter P are generated, and the data which constitute the output picture signal V_{out} using the multiplier data W_i are generated at data generation section 502c. Therefore, in the picture signal

processing section 502, processing of the function chosen with Parameter P will be performed. If it puts in another way, the function of the picture signal processor 500 can be switched by changing the value of Parameter P.

[0349] Thus, according to the picture signal processor 500 shown in drawing 35, each function of a resolution rise, noise oppression, decoding of an MPEG signal, decoding of a JPEG (Joint Photographic Experts Group) signal, and the conversion to a component signal from a composite signal is realizable with single equipment.

[0350] Moreover, as a resolution rise, although the resolution of the direction of space was mentioned as the example this time, the resolution of the direction of time amount is also considered. Moreover, a function can be switched between single dimension Y/C separation, 2-dimensional Y/C separation, three-dimensions Y/C separation, etc.

[0351] In addition, Parameter P may be designed so that a user may input, and according to the description of the input video signal V_{in} , a parameter may be made to be set up in the picture signal processor 500 of drawing 35 automatically. Moreover, you may make it choose each tap according to the value of Parameter P in the class tap selection circuitry in class detecting-element 502a, or the prediction tap selection circuitry in data generation section 502c.

[0352] Moreover, although Parameter P showed what takes a discrete value in the picture signal processing circuit 500 of drawing 35, this parameter P can consider what takes a continuous value. In this case, if the multiplier data W_i corresponding to Parameter P are one of the things using the linear interpolation which used discrete multiplier data, or multiplier kind data, they can be obtained by assigning the value of that parameter P. Thus, by taking a continuous value, as shown in drawing 36, Parameter P is one of those which decode the MPEG signal of rates a and b, and the decode of the MPEG signal of the rate of the arbitration between these rates a and b of it is still also attained.

[0353] Moreover, the function in which a switch is performed by the picture signal processor 500 of drawing 35 is an example, and is not limited to this. Of course, a switch of other functions can also be performed by the same

configuration.

[0354] Moreover, in the gestalt of the above-mentioned practice, although the case where an information signal was a picture signal was shown, this invention is not limited to this. For example, when an information signal is a sound signal, this invention can be applied similarly.

[0355]

[Effect of the Invention] According to this invention, the information data which constitute the 2nd information signal out of the information data which constitute the 1st information signal out of two or more functions corresponding to the value of the parameter which opts for the function of 1 are generated, and single equipment can realize processing of two or more functions.

[0356] According to this invention, in case the 1st information signal is changed into the 2nd information signal, the 2nd information signal can be generated corresponding to the value of two or more kinds of parameters, and two or more shafts can adjust freely the quality of the output obtained by the 2nd information signal.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the configuration of the television receiver as a gestalt of operation.

[Drawing 2] It is drawing showing the example of a user interface for adjusting image quality.

[Drawing 3] It is drawing having expanded and shown the adjustment screen.

[Drawing 4] It is drawing for explaining the pixel physical relationship of 525i signals and 525p signals.

[Drawing 5] It is drawing for explaining the pixel physical relationship of 525i signals and 1050i signals.

[Drawing 6] It is drawing showing an example of a prediction tap with the pixel physical relationship of 525i and 525p.

[Drawing 7] It is drawing showing an example of a prediction tap with the pixel physical relationship of 525i and 525p.

[Drawing 8] It is drawing showing an example of a prediction tap with the pixel physical relationship of 525i and 1050i.

[Drawing 9] It is drawing showing an example of a prediction tap with the pixel physical relationship of 525i and 1050i.

[Drawing 10] It is drawing showing an example of a space class tap with the pixel physical relationship of 525i and 525p.

[Drawing 11] It is drawing showing an example of a space class tap with the pixel physical relationship of 525i and 525p.

[Drawing 12] It is drawing showing an example of a space class tap with the pixel physical relationship of 525i and 1050i.

[Drawing 13] It is drawing showing an example of a space class tap with the pixel physical relationship of 525i and 1050i.

[Drawing 14] It is drawing showing an example of a motion class tap with the pixel physical relationship of 525i and 525p.

[Drawing 15] It is drawing showing an example of a motion class tap with the pixel physical relationship of 525i and 1050i.

[Drawing 16] It is drawing for explaining the Rhine **** processing in the case of outputting 525p signals.

[Drawing 17] It is drawing showing the concept of an example of the generation method of multiplier kind data.

[Drawing 18] It is the block diagram showing the example of a configuration of multiplier kind data generation equipment.

[Drawing 19] It is drawing showing an example of the frequency characteristics of a band-pass filter.

[Drawing 20] It is drawing showing the concept of other examples of the generation method of multiplier kind data.

[Drawing 21] It is the block diagram showing other examples of a configuration of multiplier kind data generation equipment.

[Drawing 22] It is drawing for explaining the noise addition approach.

[Drawing 23] It is drawing showing the example of generation of SD signal (parameters r and z).

[Drawing 24] It is drawing showing an example of the adjustment screen of Parameters r and z.

[Drawing 25] It is drawing showing the example of generation of SD signal (parameters h, v, and z).

[Drawing 26] It is drawing showing an example of the adjustment screen of Parameters h, v, and z.

[Drawing 27] It is the block diagram showing the example of a configuration of a picture signal processor for software to realize.

[Drawing 28] It is the flow chart which shows the procedure of a picture signal.

[Drawing 29] It is the flow chart which shows multiplier kind data generation processing (the 1).

[Drawing 30] It is the flow chart which shows multiplier kind data generation processing (the 2).

[Drawing 31] It is the block diagram showing the configuration of the television receiver as a gestalt of other operations.

[Drawing 32] It is the block diagram showing the example of a configuration of multiplier data generation equipment.

[Drawing 33] It is the flow chart which shows the procedure of a picture signal.

[Drawing 34] It is the flow chart which shows multiplier data generation processing.

[Drawing 35] It is the block diagram showing the configuration of the picture signal processor as a gestalt of other operations.

[Drawing 36] It is drawing showing the correspondence relation between the value of Parameter P, and a function.

[Description of Notations]

100,100' ... A television receiver, 101 ... System controller, 102 ... A remote control signal receive circuit, 105 ... A receiving antenna, 106 ... Tuner, 107 ... An external input terminal, 110,110' ... Picture signal processing section, 111 ... The display section, 112 ... An OSD circuit, 115 ... Adjustment screen, 115a ... An icon, 121 ... The 1st tap selection circuitry, 122 ... The 2nd tap selection circuitry, 123 ... The 3rd tap selection circuitry, 124 ... Space class

detector, 125 ... A motion class detector, 126 ... A class composition circuit,
 127 ... Presumed prediction arithmetic circuit, 128 ... A normalization
 arithmetic circuit, 129 ... A line sequential conversion circuit, 130-133 ...
 Register, 134 ... A coefficient memory, 135,135' ... Information memory bank,
 136 ... A multiplier generation circuit, 137 ... A normalization multiplier
 generation circuit, 138 ... Normalization coefficient memory, 150,150' ...
 Multiplier kind data generation equipment, 151 ... Input terminal, 152 ... SD
 signal generation circuit, 153 ... The 1st tap selection circuitry, 154 ... The 2nd
 tap selection circuitry, 155 ... The 3rd tap selection circuitry, 156 ... A tap
 selection-control circuit, 157 ... Space class detector, 158 ... A motion class
 detector, 159 ... A class composition circuit, 160,171,173 ... Normal equation
 generation section, 161,174 ... The multiplier kind data decision section, 162 ...
 Multiplier kind memory, 172 ... The multiplier data decision section, 180 ...
 Multiplier data generation equipment, 200 ... A remote control transmitter,
 200a ... A joy stick, 300 ... Picture signal processor, 301 [... Bus,] ... CPU,
 302 ... ROM, 303 ... RAM, 304 305 ... A hard disk drive, 307 ... Floppy (R) disk
 drive, 308 ... 309 The communications department, 312,313,316,317 ...
 Interface, 310 ... A remote control signal receive circuit, 311 ... A display,
 314 ... Input terminal, 315 [... An input terminal, 502 / ... The picture signal
 processing section, 503 / ... An output terminal, 502a / ... A class detecting
 element, 502b / ... The multiplier data generating section 502c / ... Data
 generation section] ... An output terminal, 400 ... A communication network,
 500 ... A picture signal processor, 501
